NAS 1.9/4: 15/22

VOLUME 15/NUMBER 22
NOVEMBER 23, 1977
ACC. NOS. N77-31070 TO N77-32071

DEC 12 1977

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 15, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

US ISSN 0036-8741

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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07 AIRCRAFT PROPULSION AND POWER 2896

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

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23 CHEMISTRY AND MATERIALS (GENERAL) **N.A.**

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **2910**

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28 PROPELLANTS AND FUELS **2922**

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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 3013
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 3016
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 3016
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 3016
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 3020

89 ASTRONOMY 3020
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 3020
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 3020
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 3021
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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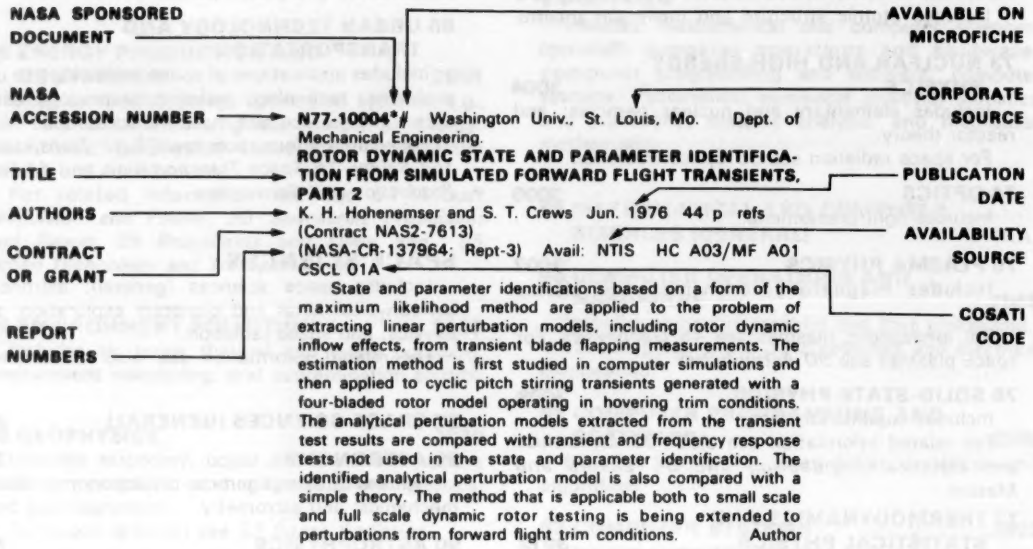
TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
(Contract NAS2-7613)
(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, DEVELOP ANALYTICAL PROCEDURE FOR PREDICTING RCS OF RADAR ABSORBING MATERIALS - ARMY AIRCRAFT

H.C. HEATH, Northrop Corporation, *Hawthorne, California* 90250 (DA0D4069; DAAJ02-76-C-0059)

To develop the analytical procedures required to predict the radar cross section (RCS) of Army aircraft fabricated from composite materials treated with radar absorber materials (RAM). These procedures will include the RAM treatment of the fuselage, tailboom, rotors, and stationary airfoil surfaces to be incorporated in the current Army aircraft RCS prediction programs, HELISCAT and Doppler.

This effort will be performed in two tasks: computer program improvement, and computer program adaptation and verification. The first task, computer program improvement, will incorporate the RAM applications and general improvements involving new techniques into the current HELISCAT and Doppler programs developed under contract DAAJ02-75-C-0002. The second task, computer program adaptation and verification, will involve the mechanics of computer coding, debugging, and verification of the newly incorporated RCS analytical procedures.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0002, VISCOELASTIC BEHAVIOR OF THE INTERVERTEBRAL DISC RELATED TO EJECTION SHOCK

W.G. KNAUSS, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF046780; AF-AFOSR-3139-77)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including flail and impact. The body in general and the musculoskeletal system particularly is adversely affected by these forces. This is of special importance in cases of ejection from high-performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - the main mechanical function of the spine is support of the upper body and transmit the weight/force to the legs. The lumbar region is subjected to most of the load. One of the more common injuries is lumbar disc compression failure. A qualitative model for the mechanical behavior of the disc is needed. Objective - the overall objective of this research is to improve the knowledge of the physiology and mechanical properties of the human intervertebral disc. How research contributes - this work should provide essential information to understand the short duration, transient loading problems of the spinal discs and contributes directly to Subarea 1.6 'Mechanical Forces' and will also be applicable to the fields of diagnostic, preventive and reparative medicine.

The researchers will delineate the inherent actions of the disc to mechanical load and define these physiologic and anatomical changes in terms of engineering parameters and constants.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0003, AUTOROTATION MANEUVER CHARACTERISTICS OF HELICOPTERS

R.E. STUDWELL, Sikorsky Aircraft Company, *Stratford, Connecticut* 06602 (DA0D4077; DAAJ02-76-C-0066)

A mathematical model for evaluating the autorotation landing capability of current and future Army helicopters shall be established. An analytical investigation will then be conducted to delineate the sensitive parameters and limits that affect the quality of the autorotative entry and landing of helicopters.

The modification of an existing analytical method shall be performed resulting in an efficient and economical computerized mathematical model for the evaluation of the autorotative capability of current and advanced helicopter systems. Through the previously modified computer evaluation technique, sensitive or limiting parameters affecting AH-1G, UH-1D, OH-6A, and OH-58A helicopter autorotation entry and landing capabilitiies will be determined with baseline aircraft results compared with flight test data. In addition, an autorotation landing index based on energy and time factors shall be computed and catalogued for the subject baseline helicopters.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0004, MOTION DRIVE SIGNALS FOR FLIGHT SIMULATORS

W.T. HARRIS, U.S. Navy, Computer Laboratory, *Orlando, Florida* 32813 (DN794017)

Develop several methods for calculating motion drive signals in flight simulators and relate them to motion system characteristics and flight maneuvers. Determine appropriate computation techniques to predict future vehicle position in order to compensate for delays inherent in motion and visual systems.

Select several methods for calculating motion drive signals from those described in the literature. This preliminary selection will be made upon considerations as: application to Navy training, ease in implementation, and estimated effectiveness. The methods chosen will be further developed and tailored to specific Navy problems such as carrier landing, in-flight maneuvers and weapon delivery. The methods will then be programmed using the NavTraEquipCen's research simulator and tested using Navy pilots.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Computer Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0005, A LOW-COST GUIDANCE AND CONTROL METHOD FOR AN ATTACK HELICOPTER AIR-TO-AIR WEAPON

B.H. SCHEINER, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5700)

The objective is to study the feasibility of a low-cost module containing an imager, guidance and control functions, and a fuse. This module would be used on rockets fired from helicopters, and would operate in one of two modes: as a semiactive laser-guided weapon if a laser designator illuminated the target during the en-

tire flight, or as an 'intelligent' target homing device when the target is illuminated by a laser for a short time before the rocket is launched. In the latter mode, the module would allow a 'fire and to get' capability with a significant effectiveness against both helicopter targets and heavy material on the ground.

A solid-state charge-coupled imaging array with suitable filters and optics would be used as the target seeker. A microcomputer system would be programmed with a scene analysis algorithm capable of using the information from the seeker to generate guidance control signals to the control section. Vehicle control would be provided by vectored fluidic gas reaction jets. A remote set capability would provide energy for initial power-up as well as relay information from the pilot. Given this information, the proximity sensor mode optimum for either air or ground targets would be selected.

ADDENDA: Supporting agency address is: DARCOM Harry Diamond Lab, 2800 Powder Mill Road, Adelphi, MD 20783

SUPPORTED BY U.S. Dept. of Defense, Army

1.0006, HORIZONTAL NAVIGATION TACTICAL DISPLAY

G.T. BURTON, Radio Corporation of America, *Burlington, Massachusetts* 01803 (DN781224; N62269-76-C-0134)

To determine the optimum design characteristics for a horizontal navigation tactical display for a 1980 era aircraft. The horizontal display is intended to provide the pilot navigational information on full color map display. The horizontal display will also present stored imagery and dynamic symbology. This contract supports work unit ZA1018 agency accession No. DN681080.

To conduct the exploratory development of laser holographic techniques and material for a pilot horizontal display system.

ADDENDA: supporting agency address is: NADC, Air Vehicle Technology Dept, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0007, FATIGUE CRACK GROWTH UNDER RANDOM LOADING USING ANALOG COMPUTERS

J.F. MCCARTHY, Mass. Inst. of Technology, Center for Space Research, *Cambridge, Massachusetts* 02139 (DF137400; F33615-76-C-3109)

Structural safety of current and future USAF tactical and strategic aircraft is a continuing problem. To insure that prescribed levels of safety are achieved for individual aircraft, methods must be developed to assess the variability of crack growth caused by variations in aircraft service loading within a given mission profile. These methods will lead to improved tracking programs providing increased safety and more cost-effective operation of USAF aircraft.

Analog computation schemes for crack growth calculations have been demonstrated to be feasible and useful for Monte Carlo simulations to obtain final crack size distributions for simple crack growth models. This effort will extend the analog simulation technique to more sophisticated crack growth models and load history representations by incorporating stress ratio effects and ground-air-ground cycles.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBEB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0008, DEVELOPMENT OF DIRECT DRIVE CONTROL VALVE FOR FLY-BY-WIRE FLIGHT CONTROL SYSTEM ACTUATORS

J.E. RINDE, General Electric Company, *Binghamton, New York* 13902 (DF136700; F33615-76-C-3037)

Present aircraft utilizing fly-by-wire (FBW) flight control systems use separate 'secondary actuators' to drive the main control valves of the flight control surface actuators. These secondary actuators are complex, heavy, and costly, utilizing contamination sensitive, low-force, electro-hydraulic 'pre-amp' spools and contain single point failure mechanical elements. The objective of this effort is to mechanize and demonstrate the viability of a direct valve drive mechanization utilizing high force transducers as a practical and effective means of reducing FBW servomechanism complexity, weight, and cost.

A program will be conducted to develop a device wherein the main actuator control valve is directly driven by high-force output transducers for fly-by-wire system applications. The valve shall contain a conventional dual tandem spool driven by two transducers. The unit and its control loop shall be a single-fail operate system. The program shall consist of (1) design study to determine optimum transducer/valve combination, (2) design of experimental valve/valve driven unit for assembly on existing dualized actuator, (3) fabrication of bench model, and (4) laboratory testing.

ADDENDA: supporting agency address is: AF Flight Dynamics Laboratory FGL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0009, V/STOL EJECTOR SCALING STUDY

F.J. BELLAR, Rockwell International Corp., *Columbus, Ohio* 43216 (DN681202; N62269-75-C-0470)

The objective of this contract is to investigate the interaction of flow and configuration parameters on the performance of various scaled ejector configurations. This task will identify the primary influencing parameters and scaling laws for application of model test data to full scale configurations. This contract supports work unit MX202.

(1) Utilizing existing hardware, investigate the effects of flow parameters, inlet diffuser geometries and primary flow injection conditions on ejector augmentation ratio to identify friction, duct and diffuser losses. (2) Employ scaled configurations of the baseline ejector system to determine similar effects and develop scaling laws for various parameters to apply to test results. (3) On several configurations, design and test three-dimensional models to determine scaling parameters for projection to vehicle application.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0010, ADVANCED DIGITAL CONTROL TECHNIQUES

J.E. HUNTER, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140210)

The advanced digital control techniques program will expand the technical credibility and data base for future Air Force advanced development programs. Many methods of modern control are not possible without the computational capabilities of a digital computer. Research programs by nature require frequent design changes, comparison of alternate designs, and system fault identification. These tasks are easily accomplished digitally. With this effort we will investigate techniques based on the unique computational capabilities of digital systems and develop criteria for incorporation of precision space control into the aircraft flight control/navigation system. Operational concepts demand that commanders have the ability to exercise precise spatial control over large numbers of dissimilar aircraft in any environment. This program will address these needs.

Design, fabricate, and flight validate a digital autoland system. Develop the in-house capability to modify this restructurable system to perform flight research. Conduct advanced research on modern flight control techniques and their application to future system requirements.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FGT, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0011, ANALYSIS OF INVENTORY/RESUPPLY SUBSYSTEM MODELS IN OPTIMAL MATERIEL DISTRIBUTION SYSTEM DESIGN

A.Z. KOVACS, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (DF047590; AF-AFOSR-3266-77)

AF function - to design an effective air-freight transportation system in conjunction with an optimal inventory system to deliver

spare parts and other high-priority equipment. Deficiency - the large number of commodities, air bases, types of cargo-aircraft, possible levels of inventory for each item at each logistics center make the optimization problem virtually impossible to solve in its entirety. Objective-to treat the inventory part of the problem separately and to inquire into ways to evaluate the effects of possible trade-offs between money invested in larger inventories and in more elaborate transportation arrangements. How work contributes - the research to be performed has the potential for saving the USAF large sums of money for the same performance in the logistics area, or increased performance for the same monetary outlay.

The plan is to examine various queueing models for the inventory part of the AFLC set-up to see which are the most important factors in the trade-off problem involving transportation and inventories.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0012, AIRCRAFT VEHICLE TECHNOLOGY (BLOCK)/FLIGHT DYNAMICS

C.J. MAZZA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN681201)

To improve the operational effectiveness and the procurement economy of all naval aircraft with emphasis on V/STOL aircraft through the exploratory development of near-mature theories and concepts in the specific areas of aerodynamics, flight dynamics and other directly interrelated aircraft technologies. Block funded beginning fiscal year 1977.

The development of selected, near-mature theories, concepts and aircraft systems to a level appropriate for continued advanced development to operational introduction shall be accomplished through both Navy in-house and contracted resources. Multiple programs are directed specifically toward the development of V/STOL aircraft technology, the improvement of combat effectiveness, performance, stability and control, operational versatility and flight safety for all piloted naval-airborne systems with primary emphasis on ship-based vehicles. Through coordination with NavAir-320D the programs are planned, implemented, managed and in some selected cases conducted by NavAir-DevCen.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Tech Admin (Aero and Structures), Washington, DC

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0013, IMPROVEMENT OF C-81 USING AH-1G DATA

J.R. VANGAASBEEK, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D4087; DAAJ02-77-C-0003)

To validate the capability of the rotorcraft flight simulation, computer program C-81 to predict rotor blade loads and motions, rotor hub/shaft loads and motions, fuselage accelerations and vibrations and other flight parameters including engine torque, aircraft attitude, control positions and main and tail rotor power and to assess the adequacy of the data obtained under contract DAAJ02-73-C-0105 for correlation/validation purposes.

The rotorcraft flight simulation will be modified to improve the rotor loads calculation. Other minor modifications will be made to the computer program to aid simulation of flight test maneuvers and to provide better understanding of the computed results. A correlation of the program with flight test data from the aerodynamic and structural loads survey of the AH-1G will be used to evaluate the accuracy of the program, the adequacy of the flight test data gathering techniques and overall plan and the suitability of the data for computer program validation.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab, Eustis Dir, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

1.0014, EVALUATION OF BEARINGLESS MAIN ROTOR STABILITY USING TRASTAN COMPUTER ANALYSIS

L. SUTTON, Systems Research Labs. Inc., *Newport News, Virginia* 23602 (DA0D4057; DAAJ02-76-C-0032)

To analytically define regions of aeroelastic instability for bearingless main rotor (BMR) and to determine design parameters which can cause such instabilities to occur. This work will be directed toward a careful evaluation of the individual design characteristics of the bmr (i.e., rotor dimensions, stiffness distribution, control system coupling, etc.) performed independent of the primary BMR effort in an attempt to uncover sources of instability before the design is finalized and fabrication has been initiated.

Input data necessary to analyze BMR stability using TRASTAN computer program will be carefully prepared. Where data must be approximated, the significance of the input will be studied to determine if the particular characteristics needs further attention during BMR design. The resulting input will be used to perform stability analysis including appropriate variation of important parameters. Results will be evaluated and documented in a letter report to help avoid problems in developing final system hardware.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Laboratory, Eustis Directorate, Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense, Army

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STATISTICAL ANALYSIS OF STEADY STATE COMBUSTION OF NONMETALLIZED COMPOSITE SOLID PROPELLANTS

R.L. GLICK, Thiokol Chemical Corporation, *Huntsville, Alabama* (DF044910; F49620-76-C-0008)

AF function - nearly all future Air Force rocket propulsion systems will use solid propellants. Deficiency - current capabilities do not permit the prediction of steady or unsteady combustion behavior of these propellants. Objective - this research is to predict the steady and unsteady combustion characteristics through detailed computer modeling of the burning. How work contributes - when successful, this work will permit choosing accurate formulations of complete families of propellants to meet desired performance characteristics after a very small number of relatively inexpensive tests.

Recent advancements in steady-state, composite propellant combustion modeling have been made by assuming that the topography of the burning surface is a fuel plain dotted with concave and/or convex oxidizer surfaces and the macroscopic flame structure is an ensemble of non-interacting quasi-one-dimensional flames. By describing the flames in the ensemble with a modified BDP model and employing statistical concepts, a combustion model for additive-free propellants with mixed, polydisperse, spheroidal oxidizer has been developed. Moreover, a strategy for including binder and oxidizer melts within the framework of the model has been developed, but not implemented. Consequently, major impediments to physically realistic modeling are believed to be associated with interacting flames, additives, nonplanar fuel surface, and interacting binder and oxidizer melts. Proposed research is directed at inclusion of melts and interactions in the model. Melt effects will build upon past work and interactions will build Miller's approach.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0002, LASER-INDUCED CHEMISTRY OF PROPELLANTS

R.A. SHATAS, U.S. Army, Physical Sciences Directorate, *Huntsville, Alabama* 35809 (DA0F1222)

Demonstrate and investigate the production of decarborane-14 by laser-induced photochemistry. Demonstrate and investigate laser, initiated fast curing of propellants.

A laser-induced photochemistry facility will be designed and assembled to include a multigas tunable high-power pulsed IR laser and a Fourier transform spectrometer for time-resolved

measurement of reaction intermediates. Initially, multiline laser experiments will be performed in an attempt to validate pulsed laser enhancement of hydroborane and carborane formation. Experiments on laser curing of propellants will also be performed. Associated theoretical calculations will be performed.

ADDENDA: Supporting agency address is: MICOM Physical Sciences Directorate, MSL RD & E Lab, Redstone Arsenal, AL 35809

SUPPORTED BY U.S. Dept. of Defense, Army

3.0003, SEMI-ACTIVE CAMOUFLAGE FOR AIRCRAFT

F.H. DAVIS, U.S. Navy, Weapons Center, *Ridgecrest, California* 93555 (DN782030)

To determine the feasibility of using fluorescent materials in a type of paint to simulate the sky in color and intensity. Ambient near-ultraviolet in daylight would be utilized to excite the fluorescence. the potential application would be in an aircraft coating which would blend with the sky background, greatly reducing the aircraft's detectability.

(1) Evaluate a variety of fluorescent materials in the laboratory using a double-beam spectrofluorimeter. Present candidates are substituted anthracenes, coumarins, and quinolones. (2) Establish compatibility between selected dyes and paint vehicles. (3) Experimentally demonstrate that one or more compositions do, in fact, materially reduce the contrast of an object against the sky.

ADDENDA: Supporting agency address is: Naval Weapons Center, China Lake, Calif. 93555

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0004, LOW-COST GRAPHITE/THERMOPLASTIC COMPOSITE STRUCTURES

W.F. WENNHOLD, General Dynamics Corporation, *San Diego, California* 92138 (DN681286; N62269-75-C-0386)

To demonstrate and evaluate the cost savings attainable through design to low manufacturing cost by application of graphite-reinforced thermoplastic composites to representative aircraft structural components. The specific objective of this program is to extend the previous work under other contracts to the general area of stiffened, curved fuselage structural panels for advanced Navy aircraft. This work is in support of work unit ZA101, 'Aircraft Technology,' agency accession No. DN 681080.

Test panels of representative construction suitable for use in the fuselage areas of advanced V/STOL aircraft will be designed, fabricated, and tested. Emphasis will be placed upon the post-forming of complicated shapes from flat stock and the fusion-joining of these shapes to flat and/or curved panels. Based on the results of these design and test tasks, a conceptual design study of a forward fuselage, utilizing all-composite construction, will be performed. The study will evaluate weight and projected production cost for typical advanced aircraft.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0005, ENHANCEMENT OF TITANIUM FATIGUE RESISTANCE

C.M. GILMORE, George Washington University, Graduate School, *Washington, District of Columbia* 20006 (DN590206; N00019-76-C-0671)

The purpose of this program is to determine metallurgical variables which enhance microstructure stability of titanium alloys (principally Ti-6Al-4V) under fatigue conditions.

The approach in this program is two-fold. First, determine the mechanism that produces longer fatigue lives in solutions-treated and quenched alloys and under what environments the resultant microstructures are stable. Second, determine crack initiation and propagation modes by means of inertial friction measurements.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0006, CORROSION OF FIBER COMPOSITES WITH ALUMINUM ALLOY-MATRIXES 14350-MS

M. METZGER, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0E9290; DAAG29 77 G0025)

To investigate the principles governing the corrosion behavior of fiber-composite materials with aluminum alloy matrixes when exposed to aqueous and atmospheric environments. Relevance - the Army evaluators cite relevance of this investigation to potential utilization of fiber-reinforced aluminum matrix composites in aircraft, missiles, equipment such as bridges, and in design concepts for general application of composite materials.

Research will include: (1) the galvanic effects of coupling graphite and alumina fibers to aluminum matrix will be studied to determine the electrochemical reactions and their kinetics as a function of sample geometry and environment chemistry; (2) effects of interface layers and identification of relation between selective attack at the interface and the interface phases present, and effects of interfacial layer thickness on corrosion behavior; and (3) study of crevicing and other localized attack whick may be caused by incomplete fiber-matrix interfacial bonding.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

3.0007, STRESS CORROSION CRACKING OF HIGH-STRENGTH ALUMINUM ALLOYS

E.N. PUGH, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DF046670; AF-AFOSR-3175-77)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Opportunity - hydrogen-related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Objective - this investigation will identify the role played by hydrogen in stress corrosion cracking of high-strength aluminum alloys through brittle film analysis, crack growth studies, hydrogen permeation studies, and hydrogen charging experiments. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Specific emphasis will be placed on the role of hydrogen in the intergranular stress corrosion cracking of high purity Al-Zn-Mg ternary alloys (7000-series model). The research will pursue four major issues: the possibility of hydride formation as a brittle film on fracture surfaces, hydrogen diffusion in the grain boundary region ahead of the crack as the rate limiting step in the cracking process, control of the diffusion process by modifying the microstructure, and correlation of crack velocity with direct measurements of hydrogen diffusion, correlation of hydrogen concentration to ductility loss.

ADDENDA: Supporting agency address is: AF office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0008, PRINCIPAL PROCESSES IN THE RADIOLYSIS OF GASES WITH FISSION RECOILS AND GAMMA RAYS

G.G. MEISELS, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (EY-76-S-02-2567)

Major objectives of this research are the determination of the temperature in the fission recoil track, of the lifetimes of ion-molecule reaction adducts, and of the rates of internal rearrangements of molecular ions before fragmentation. In the first area, we shall employ competition kinetics involving reactions with different temperature dependencies and irradiate with recoiling fission fragments from a 2.5 micron thick, platinum-clad, uranium 235-palladium foil suitably encapsulated in a reaction vessel and immersed in the thermal neutron flux of a swimming pool reactor, with subsequent analysis by radio-gas chromatography. Mass spectrometric measurements will employ a high-pressure (1 torr)

pulsed mass spectrometer capable of measuring ion residence times in the range of one microsecond to one millisecond. A second mass spectrometer is based on the detection of photoelectrons with no kinetic energy and coincident measurement of ions produced in the same act to define the internal energy of the parent ion entirely. Application will be primarily to simple hydrocarbon gases such as propane, methane, olefins, and to low boiling liquids such as methanol, acetaldehyde, etc., with suitable additives.

RESULTS: Fission recoil measurements have established that in 0.06g/cc ethylene temperatures of the core of the track are about 800 to 1000 degrees K. Angular momentum resulting from the collision process was shown to play an important role in determining the lifetime of intermediate complexes. Threshold photoelectron spectra of carbon dioxide showed that bent valence states of the ion appear to be accessible through autoionization.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

3.0009, FATE OF SELECTED AIR FORCE PROPELLANTS AND LUBRICANT ADDITIVES IN THE AQUATIC ENVIRONMENT

H.C. SIKKA, Syracuse University Res. Corp., *Syracuse, New York* 13210 (DF046860; F49620-77-C-0027)

AF function - a number of chemicals including missile propellant and lubricant additives are widely used in Air Force operations. These are introduced into the aquatic environment through routine operations, spills, and waste-discharge effluents, and are of concern due to their potential toxicity. They may affect man through the drinking water supply, accumulate in the food chain, or be converted to other products with even greater toxicity. Deficiency - little information is available on the environmental fate of Air Force missile propellants and lubricant additives. Objective - this research will address the environmental fate of selected Air Force chemicals to evaluate the hazards associated with their release. How research contributes - results of this study should provide information needed to establish guidelines regarding discharge of Air Force products into water systems subject to state and federal regulations. This research directly supports subarea 1.9 'Environmental Protection' and RO 1.9.1 'Health Effects'.

The study will investigate the degradation of UDMH and PNA in naturally occurring aquatic communities, identify the resulting products, determine sorption and desorption of the chemicals in lake sediment, examine uptake and transformation by phytoplankton and determine uptake and metabolism by fish.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0010, PRELIMINARY BROADLINE NMR STUDY OF EPOXY RESINS

J.D. MEMORY, Univ. of North Carolina, School of Math. & Phys. Scis., *Raleigh, North Carolina* 27607 (NSG 1423)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

3.0011, STUDIES OF MECHANICAL PROPERTIES AND IRRADIATION DAMAGE NUCLEATION OF HTGR GRAPHITES

P.A. THROWER, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (EY-76-S-02-2712)

Irradiation of pyrolytic graphites, some of which have been doped with boron (B') will be performed at high temperatures (1000-1900 degrees C) and in high-energy neutron spectra (up to 15 MeV) will be examined in the transmission electron microscope. The purpose of this work is to understand the role of boron in damage nucleation at high temperatures and to provide some correlation between damage produced in neutron spectra of quite different energies.

The effect of gasification by O2, CO2, H2O and H2 on the mechanical properties of graphite will be examined using a range of materials manufactured from identical raw materials but using different binder/filler ratios and processing temperatures so as to provide different densities and resistances to gasification. It is hoped to thus determine the relative role of binder and filler on the gasification rate and the effects of different reactant gases or degradation of mechanical properties.

Results on the gasification of graphite using He/CO2 and He/H2O gas mixtures at approximately 1000 degrees C have shown an increase in reaction rate with increasing flow rate, followed by a decrease as the flow rate is further increased. The effect of gas flow rate will be studied in greater detail in an attempt to understand this phenomenon.

RESULTS: Degradation of the compressive strength of Stackpole 2020 and Great H440 graphites as a result of gasification in air show a 50 percent strength reduction after 8-9% weight loss. Strain to failure remains constant up to 25-30% burn-off in 2020 and then increases rapidly while no such effect is seen in H440. Binder material gasifies more rapidly than filler material.

No effect of compressive strength on oxidation rate in He/H2O and He/CO2 gas mixtures has been found. Stresses up to a 1000 p.s.i. and reactant gas concentrations up to 1000 p.p.m. have been used with temperatures in the range 800-1000 degrees C. An inversion in reaction rate with increasing gas flow rate has been found for both reactants. This occurs in the gas velocity range 2-5 mm/sec.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Physical Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AEROSERVOELASTICITY

M.A. CUTCHINS, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DF641530; F08635-77-C-0007)

Air Force function - this work unit is developed to define aircraft and weapons dynamic instabilities. Deficiency or opportunity - prevent aircraft loss. Objective - to establish a capability to evaluate and predict instabilities created from the interaction of the automatic control system with the aeroelastic (e.g. flutter) characteristics of the vehicle. How work contributes - this work will define aeroservoelastic instabilities for USAF aircraft when carrying various store configurations.

The techniques and procedures necessary to perform an aeroservoelastic analysis of a winged vehicle will be explored.

ADDENDA: Supporting agency address is: AF Armament Laboratory DLJC, Eglin AFB, Fla 32542

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0002, SUPERCONDUCTIVITY AND ITS RELATION TO NAVY USE

W.A. LITTLE, Unknown Inst. or Indiv. Grant, *California* (DN590186; N00019-76-M-0640)

To assess the present state-of-the-art of superconductivity in view of potential applications for the Naval Air Systems Command.

Theoretical study.

Addenda: supporting agency address is: naval air systems command washington, d c 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0003, NEW METHODS FOR ANALYSIS OF THE PERFORMANCE OF GUIDANCE AND CONTROL SYSTEMS

R.S. BUCY, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DF045840; AF-AFOSR-3100-76)

AF function - estimation is a singularly important aspect of the design of high-accuracy guidance, navigation and control systems for sophisticated AF systems. Deficiencies - the estima-

tion or noise filtering problem in many cases is inherently nonlinear, and therefore not amenable to known linear filtering techniques. Objective - the objective of this research is to develop methods for routinely handling nonlinear filtering problems. How work contributes - better techniques for nonlinear filtering will find immediate application in improved performance and accuracy for complex systems.

Three approaches will be investigated. At great computational expense optimal nonlinear estimation has been achieved. Now parallel and pipeline digital computers will be applied to the problem, with hopes of doubling the dimensionality of problems which can be handled. The second approach is to derive easily evaluated upper and lower bounds for suboptimal filter error variance, allowing one to evaluate candidate filters before building them. Finally, an investigation of the Riccati equation, which is fundamental in questions regarding both linear and nonlinear filtering, will be conducted. It is hoped to extend the refined global existence theorems to the case of complex solutions.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0004, THE ELECTRICAL AND METALLURGICAL PROPERTIES OF DEFECTS IN COMPOUND SEMICONDUCTORS 12892-EL

G.L. PEARSON, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DA0E5574; DAAG29 75 C 0013)

To investigate the effect of vacancies and crystal defects on the electronic properties in compound semiconductors. Relevance - binary and ternary semiconductor compounds are essential materials for extremely high-frequency devices, such as Impatt or Gunn diodes, and for electrooptical applications such as in photocathodes.

Identification of vacancy defects and vacancy-impurity complexes in AlGaAs - determination of energy levels associated with Ga and As vacancies and their formation energies in GaAs.

ADDENDA: Supporting agency address is: DARCOM Army Rsch Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

4.0005, OPTICAL PROPERTIES OF SMALL BAND GAP SEMICONDUCTORS SUBJECT TO LASER EXCITATION

T.C. MCGILL, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DF047320; AF-AFOSR-3216-77)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - the far infrared region of the electromagnetic spectrum has been virtually unexplored for airborne and satellite applications. Sophisticated electrooptical techniques in narrow band-gap compound semiconductors offer promise for electrooptical microcircuitry in the spectral range 10 to 100 microns. Objective - this study investigates the effect of carriers generated by laser illumination on the optical properties of small band gap semiconductors of interest for the construction of infrared sources and detectors, and the behavior of a nonequilibrium distribution of electrons and holes produced in a small band-gap semiconductor like HGL-XCDXTE. Objectives are to determine: (1) the kinds of quantum states formed by these carriers under different conditions of carrier density and temperature, (2) the energy of these states, (3) the lifetimes of these states, and (4) the effect carriers in different quantum states have on the optical and electrical properties of the material. How work contributes - infrared detectors and tunable infrared sources of coherent radiation require solid-state materials with narrow band gaps, controlled carrier concentrations and doping to provide optimal performance characteristics. Such investigations should lead to the formulation of models and mechanisms of linear and nonlinear interactions of laser light with solids and the understanding of basic parameters that control the properties and behavior of narrow band gap semiconductors.

Experimentally, high-resolution measurements of photoluminescence, absorption and the modification of absorption by high-intensity laser excitation are being made. These measurements should provide information about states formed by photogenerated carriers under various experimental conditions. Binding energies for the states formed by the photogenerated carriers (excitons, bound excitons, electron-hole plasma) in HGCDTE are determined theoretically. Auger transition rates for bound excitons and the impurity cross section to capture a free exciton and form a bound exciton are computed.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0006, COMMUNICATIONS - ULF GENERATED BY SATELLITE BEAM

R.W. FREDRICKS, Thompson Ramo Wooldridge Inc., *Redondo Beach, California* 90278 (DN675353; N00014-76-C-0671)

Strategic communications capability is now in ULF and above with the possibility that ELF systems will eventually become operational. ULF remains a possibility with certain advantages, notably salt water penetration, but with serious generation and propagation uncertainties. It is necessary to understand the ULF phenomena to correctly assess its potential operational use.

The investigator will calculate radiation patterns and amplitudes of waves in the ULF frequency range emitted by ion beams injected from a satellite into the magnetized plasma on equatorial field lines. Calculations to assess the stability, the neutralization and other dynamics of the beam in its linear and nonlinear interactions with the ambient plasma and magnetic field will be carried out.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0007, DEVELOPMENT OF OPERATIONAL TECHNIQUES FOR INSULATIVE THERMAL PROTECTION SYSTEMS APPLICABLE TO THE X-24C

R. KIRLIN, Martin Marietta Corporation, *Denver, Colorado* 80201 (DF136820; F33615-76-C-3069)

The X-24C will require a low-cost, reusable approach to provide thermal protection for the aluminum load carrying structure. This effort shall contribute to the conceptual development of the X-24C hypersonic research vehicle by providing a basis for TPS selection through the development and evaluation of solutions to operational requirements imposed by a vehicle of the X-24C class.

The contractor shall perform a six-month technical program to develop, test and evaluate SLA-220 silicone elastomer and high-density RSI silicon block external insulation TPS systems for the X-24C. The program shall focus on TPS operational and maintenance considerations. Evaluation shall include environmental simulation experienced during the function of the X-24C flight test program. The techniques used will be based upon minimizing cost and maximizing reusability of the insulative TPS.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXS, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0008, TRANSITION TO TURBULENCE IN SHEAR LAYERS

M.V. MORKOVIN, Illinois Inst. of Technology, School of Engineering, *Chicago, Illinois* 60616 (DF046500; F49620-77-C-0013)

AF function - improved aerospace vehicles. Opportunity - increase understanding of the transition to turbulence in shear layer phenomena. Objective - prepare a self-contained comprehensive and reliable guide to the phenomenon of transition to turbulence in shear layers for use by research workers and designers. How work contributes - it will provide an understandable, comprehensive, and reliable guide on transition to turbulence in shear layers for designers to use in future aerospace vehicle designs.

All information presently available in the open literature will be collected, analyzed and organized into a self-contained monograph on transition to turbulence in shear layers. The text will identify what is considered solid, established information, what

are tentative concepts based on limited evidence, and what are conjectures and speculations.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0009, STUDY OF RADIAL FACE SEAL MECHANISM OF OPERATION
I. ETSION, Israel Inst. of Technology, *Haifa, Israel* (NSG 7317)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0010, HIGH-ENERGY PLASMA INSTRUMENT
A.L. PAVEL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249200)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the data base of the high-energy plasma present at synchronous orbit is inadequate to accurately describe observed charging events or to properly relate them to their ultimate cause. Objective - to provide high-time resolution energetic particle sensors for the SCATHA satellite so as to permit in conjunction with other environmental and engineering experiments aboard the SCATHA satellite, the establishment of specifications which support design criteria for space systems. How research contributes - detailed data on the influx of high-energy particles will be available from this satellite and will be analyzed as a function of time, satellite charge, solar illumination and other relevant parameters.

The Magnetospheric Dynamics Branch of the Space Physics Division will provide electrostatic analyzers and solid-state spectrometers for the SCATHA satellite. These instruments will define, on a rapid time basis, the influx of high-energy particles to a geosynchronous satellite. A detailed analysis will be carried out on the data from these sensors in conjunction with data from other sensors on the satellite and other appropriate geophysical parameters.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0011, ADVANCED SEMICONDUCTOR PROCESSING TECHNOLOGY
S.A. ROOSILD, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF247000)

AF function - communications, weapons delivery and surveillance. Deficiency or opportunity - solid-state device technology is presently unable to meet military requirements in frequency, power, radiation hardness and infrared detection. Objective - investigate new processing techniques that inherently permit superior control in solid-state device fabrication. How research contributes - improved control of both device geometry and doping will permit solid-state devices that are optimized for the particular function desired.

Electron and ion beam fabrication technology will be combined to achieve control over lateral device dimensions and both the spatial distribution as well as the absolute number of dopants. In addition, controlled compensation will be exploited through the use of partial annealing of ion implanted layers. Devices of immediate interest are high-valued, radiation-resistant, integrated circuit resistors and CCD coupled Schottky-IR focal planes.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0012, NAVIGATION AND FUZING SENSORS USING COHERENCE PROPERTIES
J. SETHARES, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900530)

AF function - navigation, guidance, and weaponry. Deficiency or oppgrtunity - present sensors using optical rings have the problem of mode locking. Need smaller, simpler fuzing sensors. Objective - the goal of the work on new rotation rate sensors will be to complete analysis of the behavior of acoustic and magnetic waves in rotating systems. The work on new range and velocity sensors for fusing will be aimed at demonstrating a short range sensor against slowly moving targets. How research contributes - this research will determine the practicability of elastic surface wave rate sensors and provide a measurement of their sensitivity. It will also show whether or not smaller and simpler fuzing sensors can be realized.

Ring interferometry of acoustic and magnetic surface waves is being used to develop new tachometers and gyroscopic pick-offs. Correlation characteristics of incoherent electromagnetic radiation reflected from moving targets is the basis of a new approach to range and velocity sensing of slowly moving targets. The acoustic surface waves will be generated by piezoelectric and Lorentz techniques. The magnetostatic surface waves are generated in YIG films epitaxially grown on gadolinium gallium garnet substrates. The effect of rotation is the introduction of a phase shift between two counter circulating beams in both cases.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0013, WEAPONRY - LASER PROPULSION
D.D. HAMILTON, Avco Corporation, *Everett, Massachusetts* 02149 (DN675283; N00014-76-C-0646)

The objective of this project is to assess the utilization of laser propulsion for launching satellites into low, intermediate and high orbits as well as for orbit-to-orbit transfer and suborbital missions which can have impact on satellite defense and weaponry of Navy interest.

The contractor will evaluate a number of DOD missions related to laser rocketry, assess performance requirements, capital costs, and operational costs of such a system, carry out basic optical and thermodynamic analysis of various collector and engine configurations, carry out detailed assessments of absorption mechanisms, and conduct experiments to verify the above analysis.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0014, ELECTRICAL CHARACTERIZATION OF SEMICONDUCTOR/MICROPROCESSOR DEVICES
P. BURKE, General Electric Company, *Pittsfield, Massachusetts* 01201 (DF737380; F30602-77-C-0012)

The objective of this effort is the develop guidelines for the electrical characterization and testing of semiconductor/microprocessor devices. Specific types will be thoroughly characterized and the resulting data used to prepare a detailed M38510 specification.

This will include a detailed static, dynamic, and functional analysis of the various logic arrangements within and between the various microprocessor configurations. Important features, limitations, and interchangeability criteria will be determined and compared according to established trade-offs such as power-speed, temperature-frequency, etc. In addition, special test methods for characterizing microprocessors will be developed and reported in a format compatible for use in MIL-STD-883. This effort will develop general knowledge regarding the optimum electrical test conditions for special microprocessors, and provide criteria for specifying critical electrical parameters for use in government-prepared MIL-M-38510 specifications.

ADDENDA: Supporting Agency address is: Rome Air Development Center RBR, Griffiss AFB, N Y 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0015, ELECTROMAGNETIC SCATTERING
T.B. SENIOR, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF047000; AF-AFOSR-3188-77)

AF function - radar scattering cross section reduction for aerospace vehicles. Opportunity - radar absorbing surface coatings reduce cross section. Objective - to reduce not only specular but also nonspecular or diffracted contributions to scattering cross section. How work contributes - by examining the effect that surface coating impedance has on travelling, creeping, and edge waves, edge reflections, etc.

Three research areas seem promising. First, numerical algorithms for cross section reduction for a edged finite body are now limited to low frequencies. More economical higher-frequency schemes will be sought. Second, analytic solutions to half planes with layered anisotropic impedance coatings and obliquely incident radiation will be sought through an extension of Hurd's Wiener Hopf technique. Such solutions may serve as canonical local solutions or finite elements for more general approaches. Third, studies of low-frequency scattering by absorber coated structures will use the polarization tensor approach.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0016, INTEGRATED PREAMPLIFIER/MULTIPLEXER MODULE DEVELOPMENT

D. WOYWOOD, Radio Corporation of America, *Camden, New Jersey* 08102 (DF096060; F33615-73-C-1308)

The exploratory development effort is to demonstrate and evaluate an integrated signal processing concept which is applicable to video processing systems. To accomplish this requires the development of an integrated metal oxide semiconductor (MOS) preamplifier, a charge coupled device (CCD) signal processor and the peripheral electronics functions to implement and evaluate the overall concept.

This effort shall be carried out within the strict bounds of solid-state array techniques and technology. It shall include: (1) array design, fabrication and evaluation, (2) peripheral electronic design and (3) integration and evaluation of the overall concept.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0017, FREQUENCY MANAGEMENT FOR NAP-OF-THE-EARTH (NOE) COMMUNICATION USING THE DIGISONDE

H. SOICHER, U.S. Army, Communications A.D.P. Lab., *Red Bank, New Jersey* 07703 (DA0D2922)

NOE seeks to provide reliable, securable communications from zero to 50 km range, from Army aircraft operating at nap-of-the-earth altitudes down to and including ground level. One of the communication modes is an HF (2-30 mHz) communications system optimized to take maximum advantage of nearly vertical incident skywave (NVIS) in non-line-of-site conditions. Propagation conditions, including frequency management and signal attenuation characteristics are some of the unknowns to be resolved.

The digisonde (digital ionospheric sounding system including on-line computer, drift attachment and auxiliary equipment, determines overhead ionospheric structure in real time. It also has capabilities of determining relative amplitude and phase information of its emitted probing swept signals. Thus, optimum permissible least attenuated signal use can be determined. The overhead bottomside ionosphere will be probed at Fort Monmouth at short time intervals. The variability of optimal frequency will be determined. The effects of gravity waves and other phenomena on this optimal frequency will also be determined.

ADDENDA: Supporting agency address is: ECOM Comm/ADP Lab, DRSEL-NL-RH-4, Ft Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense, Army

4.0018, MULTIPLEX INTERIOR COMMUNICATIONS

G. COTTER, Grumman Corporation, *Bethpage, New York* 11714 (DN681291; N62269-75-C-0392)

To demonstrate the utility of the GPMS and develop models in accordance with the new DOD multiplexing standard. This contract supports work unit ZC201, agency accession No. DN681082

Based on the results of the GPMS-X program, the governing NavAirDevCen specification will be updated to reflect ADM/EDM model equipment for development. With these models the total utility of the GPMS will be demonstrated relative to servicing a total aircraft internal signal capacity.

ADDENDA: Supporting agency address is: Naval Air Development Center, Aero-electronic Tech Dept, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0019, ELECTRIC-CURRENT CONTROLLED EPITAXY OF COMPOUND SEMICONDUCTORS

L.F. EASTMAN, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DF042110; AF-AFOSR-2929-76)

Microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Devices made from gallium arsenide and other compound semiconductors show great promise for improved performance and reliability in the microwave region. In order to take full advantage of the capabilities of these compound materials, it is necessary to obtain improved control over the epitaxial growth process of these semiconductors. The current method of liquid phase epitaxy (LPE) has been reasonably successful, but this method does not allow for a fast enough response time for controlling epigrowth rate or for an independent control of doping density in the epitaxial layer. This research investigates the current-controlled liquid phase epitaxial growth of gallium arsenide and indium phosphide. An electric current passing between the interface of the substrate and the melt creates a temperature gradient due to the peltier cooling which takes place. This thermal gradient will be used to control both the growth rate and the doping concentration of the epitaxial layer. A correlation of growth rate and doping concentration with current density and average melt temperature will be made. Epitaxial layers with configurations for microwave devices will be made and tested. Finally, a model will be developed to help in the understanding of epitaxial growth and doping effects of current controlled liquid phase epitaxy.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0020, DISPLAY PROCESSOR SYSTEM

J. GALLAGHER, Internat. Bus. Machines Corp., *Owego, New York* 13827 (DF319390; F33615-75-C-0095)

The objective of this effort is to provide AMRL with a display processor system (DPS) for use in advanced display concepts research. The DPS includes the helmet-mounted display processor, (HMDP), two HMDP control panels, and test set support unit. The HMDP will be configured to work in the AMRL Lab with the IBM 360/40 computer via the 1827 Data Control unit. The HMDP will contain a digital symbol generator to provide alpha-numeric and graphics writing signals to either the Hughes or Honeywell helmet-mounted display electronics as well as a panel-mounted display.

The contractor shall provide the engineering services, materials, and facilities to accomplish the complete design, fabrication, delivery and checkout of the DPS. The DPS will consist almost entirely of existing hardware modules which will be integrated to provide the DPS.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0021, DAMAGE TOLERANCE CRITERIA FOR NAVAL AIRCRAFT

D. BROEK, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DN681277; N62269-76-C-0093)

To establish damage tolerance criteria for naval aircraft structures which can be effectively applied to insure structural reliability without adding excess weight and without unnecessarily increasing either procurement or maintenance costs. This contract will be in support of W.U. ZA101, agency accession No. DN681080.

Inherent limitations in the accuracy of crack growth and residual strength analyses will be quantitatively assessed. Analyses will be performed for different combinations of crack configuration, structural geometry, spectrum shape and environment. Analytical results will be compared to controlled laboratory tests to determine the accuracy of the analytical method and the variability of the crack growth/fracture process. Recommendations will be made on how to accommodate these variants in Navy structural reliability programs.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehicle Technology Dept, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0022, SOLID-STATE RADAR DESIGN

F. LAMB, U.S. Air Force, Avionics Laboratory, *Dayton, Ohio* 45433 (DF097830)

To exploit solid-state microwave technology in combination with known radar techniques to arrive at a system concept for a complete solid-state radar transmitter/receiver configuration. This system should provide increased reliability, eliminate the size and weight of thermionic devices together with their high-voltage power supply requirements and reduce cost when compared with a conventional, mechanically scanned, air-to-ground radar system.

A multi-step analysis procedure will be used to determine the feasibility of incorporating solid-state technology into a radar system design. This analysis will include transmitter/receiver configurations implementing various radar techniques that effectively utilize the current state-of-the-art in solid-state technology. Potential solutions will be selected from configurations in terms of cost, weight/size, availability, and future usage. The investigation will continue on potential solutions through in-house experimentation to verify overall design concept in terms of reliability, maintainability and component compatibility and the optimum design selected.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0023, CRF FLOW QUALITY INVESTIGATION

R. RIVIR, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF460540)

The primary objectives of this program are to determine the steady-state and dynamic distortion levels within the test chamber and the compressor bell-mouth of the Compressor Research Facility (CRF) and to develop techniques to reduce these levels to acceptable values.

A series of tests are being carried out on a one-tenth scale model of the CRF using global Mach number scaling with flow control elements employing Reynolds number similarity. Current and planned distortion tests involve parameters such as pressure, temperature, velocity, and flow direction.

ADDENDA: Supporting agency address is: AF Aero-Propulsion Laboratory DO, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0024, LASER RAMAN COMBUSTION DIAGNOSTIC TOOL

P. YANEY, Univ. of Dayton, School of Arts & Sciences, *Dayton, Ohio* 45469 (DF459540; F33615-76-C-2078)

To determine pattern factors at the exit of a jet engine combustor using laser Raman scattering.

A laser Raman system will be modified and then used to measure temperature and species concentration profiles at the exit of a T56 jet engine combustor. The tests will be performed in a combustor rig facility. Profile data will be collected at a variety of different combustion conditions.

ADDENDA: Supporting agency address is: AF Aero-Propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0025, RADAR SIGNATURES FOR AIRCRAFT IDENTIFICATION

R.A. STRATTAN, Univ. of Tulsa, School of Engin. & Phys. Sci., *Tulsa, Oklahoma* 74110 (DF047100; AF-AFOSR-3200-77)

AF function - in addition to the detection and location of airborne targets, tactical surveillance radars may someday have the capability to passively identify such targets. Opportunity - recent advances in space object identification, high-resolution radar technology, and digital data processing indicate that radar target identification may become a reality. Objective - this research will quantify effects that may be useful or may distract from the use of microwave radar signatures for target identification purposes. How work contributes - this effort will advance tactical surveillance radars for use in identification of airborne targets.

A set of 5 to 10 simple target configurations that emphasize aircraft-like scattering mechanisms will be selected, and their scattering properties will be modeled using appropriate analytical approximations. Synthetic aperature images will be formed and the results analyzed, and the resulting models will be considered for implementation on the RADC RADSIM radar simulator. Concepts and methods for further analysis and experimental verification will be developed.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0026, SELECTED FLUID ANALYSIS FOR SPACE PROCESSING PROGRAMS

F. COLLINS, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (NAS 8-32484)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0027, INVESTIGATION OF MICROPROCESSOR SYSTEMS TO BE USED IN THE DEVELOPMENT OF A 4.75 GHZ SCATTEROMETER REAL-TIME PROCESSOR

W.C. HULSE, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (NAS 9-15311)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0028, SAW RESONATORS

D.T. BELL, Texas Instruments Incorporated, *Dallas, Texas* 75222 (DN680329; N0004-75-C-0824)

There is a need for improved secure and covert communications systems for applications ranging from voice communications to remotely piloted vehicles. The objective of this program is to develop advanced state-of-the-art VHF and UHF signal processing components for communications systems under development.

High Q filters will be developed for the VHF and UHF bands using SAW resonators. Basic limitations of these devices will be identified and overcome so far as is practical or is required for systems applications.

ADDENDA: Supporting agency address is: Naval Research Laboratory (5257), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense, Navy

4.0029, NEW PASSIVATION METHODS FOR GALLIUM ARSENIDE

H.L. HARTNAGEL, Univ. of Newcastle Upon Tyne, *Newcastle Upon Tyne, England, United Kingdom* (DA0C9319; DAERO G0019)

The technology of fabricating GaAs devices is not well developed. A specific topic not well understood is passivation of GaAs surfaces. The work has relevance to the mission of the ECOM electronics technology and devices laboratory. The proposed work is scientifically analogous to present work on silicon passivation and could be a useful forerunner of a future program. The proposed research is of particular interest to the fol-

lowing areas: (1) application of solid state detector arrays (2) field-assisted photocathodes of the 1-2 micron range and (3) device technology with emphasis on passivation for detector devices.

The selection of oxides which can exhibit similar values of lattice constants and of thermal expansion coefficients to those of GaAs, promise to result in useful passivation schemes of GaAs surfaces. First experimental results give several methods of fabricating good gallium oxide and aluminum oxide layers. These methods are now to be systematically expolored in view of optimum processing steps. The characteristics regarding interface states, pin holes, uniformity, etch and corrosion resistance, etc., are to be established by RF impedance measurements, microprobe analysis, scanning electron microscopy, etc.

ADDENDA: Supporting agency address is: DARCOM Research Standardization Group (Europe), FPO Box 15 NY 09510

SUPPORTED BY U.S. Dept. of Defense, Army

4.0030, DEVELOPMENT OF A STEREO FLUOROSCOPY SYSTEM
UNKNOWN, Virginia Poly. Inst. & St. U., Graduate School, *Blacksburg, Virginia* 24061 (NAS 9-15287)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0031, REMOTE-SENSING RESEARCH FOR LINE OF COMMUNICATION IDENTIFICATION
A.O. POULIN, U.S. Army, Remote Sensing Center, *Fort Belvoir, Virginia* 22060 (DA0N8006)

To develop methods for obtaining more rapid and accurate information of factors affecting lines of communication (LOC) in a tactical battle area. This includes cut and fill, airfields, construction material, ice bridges, etc., to evaluate and develop new procedures for using new imagery sources to derive the above information.

Representative geomorphological areas of Europe will be selected. The factors will be evaluated with respect to each area. First year effort will concentrate on soil and rock evaluation for cut and fill, airfield site selection, and construction material site selection. As time becomes available, the remaining factors will be evaluated. doctrinal awareness will enable the investigator to recommend modification to doctrine where necessary, and to develop LOC keys relevant to types of vehicles expected to operate in a given environment. Research results will be disseminated in briefings, interpretation keys, in-house technical reports and, where necessary, technical manuals.

ADDENDA: Supporting agency address is: OCE ETL Center for Remote Sensing RI, Ft Belvoir, VA 22060

SUPPORTED BY U.S. Dept. of Defense, Army

4.0032, LONG-TERM RADIATION AND TEMPERATURE EFFECTS ON GAAS SOLAR CELL CHARACTERISTICS
J.H. HEINBOCKEL, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1426)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

4.0033, A DESIGN MANUAL FOR STIRLING ENGINES
W.R. MARTINI, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (NSG 3152)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, A MODULATED DOPPLER LIDAR FOR WIND MEASUREMENT 13343-GS
R.M. SCHOTLAND, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (DA0X5573; DAAG29 76 G0115)

To develop, using a modulated beam, a Doppler lidar for wind measurement which will substantially increase range over other systems -through reduction of distortion factors. Capability for remote sensing of atmospheric motions has relevance to a number of military systems particularly to artillery and free-flight rocket technology. There also is relevance to Army aviation applications.

Studies will include theoretical analysis of signal-to-noise properties of modulated lidar systems, design and construction of a lidar wind measurement system including data handling procedures, and finally, testing of the system in the laboratory and at calibrated field site.

ADDENDA: Supporting Agency Address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

5.0002, A STUDY OF PC 3,4 MICROPULSATIONS WITH INTERPLANETARY MAGNETIC FIELD ORIENTATION
E.W. GREENSTADT, Thompson Ramo Wooldridge Inc., *Redondo Beach, California* 90278 (DF046410; F49620-77-C-0018)

AF function - the ability to predict atmospheric disturbances caused by interplanetary phenomena is a standing Air Force requirement. the capability to make these predictions from ground-based observations is particularly attractive because of the ease and economy with which these observations could be made. Deficiency - at this time there is no set of observations, from the ground or from space, that gives an accurate prediction of ionospheric disturbances. Objective - the objective of this study is to pursue the possibility that certain ionospheric disturbances occur during particular configurations of the interplanetary magnetic field. Contribution - this study will contribute to a greater understanding of the solar-terrestrial relationship and could lead to an economical predictive capability for ionospheric disturbances.

The following steps will be taken in pursuing this study: 1. improvement of the treatment of existing data to reduce the scatter in the present correlations, 2. Examination of the hydromagnetic descriptions and wave properties of the magnetosheath to refine the investigator's model of PC 3-4 excitation by characterizing more precisely the patterns of shock noise expected at the magnetopause, 3. assembly of a schedule of simultaneous acquisitions of suitable micropulsation and interplanetary field measurements to serve as a potential data base for correlation studies.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0003, NAVY ENVIRONMENT - AIR-SEA MOISTURE TRANSFER
S.C. LING, Catholic University of America, School of Engin. & Arch., *Washington, District of Columbia* 20017 (DN775086; N00014-77-C-0017)

Models of air-sea transfers over the sea are required for air-sea rescue, fog prediction, ocean circulation, terminal aircraft forecasts and other surface fleet operations. The objective of the research is to refine the preliminary model through intensive field and laboratory studies to obtain the correct rate of evaporation over the ocean.

A model of the atmospheric boundary layer over the sea will be improved to solve a coupled system of equations governing the wind, water droplets, humidity and temperature fields. Field experiments at sea with a new device to measure liquid water in boundary layer will be tested to get data for model.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0004, NAVY ENVIRONMENT - THE INTERACTIONS AMONG SURFACE WATER WAVES AND WITH INTERNAL WAVES AND ELECTROMAGNETIC WAVES
J.W. WRIGHT, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580066)

The major purpose of this effort is to determine the dependence of short gravity wave and capillary wave amplitudes on windspeed, currents, surfactants, air-water temperature difference and to develop theories in conjunction with the measurements which will yield quantitative descriptions of the fine structure of the air-sea interface. Such knowledge is necessary for a variety of naval applications including surveillance of the surface weather over the oceans from satellite and OTH radars for ship routing, especially hydrofoils, to non-acoustic anti-submarine warfare.

Microwave scattering techniques at 1.8, 4.3, 9.375, 23.9 and 70.1 gHz together with optical and photometric methods will be used to measure phase speeds, temporal growth, relaxation rates, and modulations due to straining and Doppler spectra of wind-generated waves in wave tanks as well as on the ocean. Wind-wave interactions and higher-order Bragg scattering calculations will be made and the radiative transfer equations solved for comparison with experiment. Analytical and numerical solutions of the Orr-Sommerfield equations will be obtained to yield growth rates and to infer air-sea boundary layer properties from measured phase speeds.

ADDENDA: Supporting agency address is: Naval Research Laboratory (8000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0005, SURVEILLANCE - INVESTIGATION OF PROPERTIES OF RADAR BACKSCATTER FROM SEA ICE
R.K. MOORE, Univ. of Kansas, Center for Res. Incorporated, *Lawrence, Kansas* 66044 (DN775037; N00014-76-C-1105)

The objective of this effort is to provide backscatter properties of sea ice to permit better interpretations to be made of the sea ice imagery taken during overflights of the Arctic with remote sensors; and to establish optimum parameters for future remote ice-measuring systems.

A transportable radar scatterometer is to be assembled capable of variable frequency operation in the 12-18 gHz band and fixed frequency operation of 1.2 gHz. Using this equipment and varying the frequency, polarization, and angle of incidence, microwave measurements of Arctic sea ice (first year ice, multi-year ice and pressure ridges) are to be made to determine electrical permittivity, electrical conductivity, and ice roughness. The results are to be analyzed and the optimum design parameters for radars to be employed for remote sea ice monitoring from spacecraft or aircraft are to be generated.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0006, SCATHA DATA INTERPRETATION
H.B. GARRETT, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249050)

AF function - AF communications satellites at synchronous orbit are degraded by satellite charging induced by the plasma environment. Deficiency - the space environment during periods of satellite charging is not sufficiently defined. Objective - to plan for and conduct a rapid interpretation of the environmental data returned by the SCATHA satellite in conjunction with the SCATHA engineering sensors so that adequate design criteria might be developed to prevent degradation of future satellite communications systems. How research contributes -understanding of the satellite charging phenomenon is of critical concern to the design of future vehicles. To fully understand the processes involved, a complete picture of the charging environment must be available during each charging event. This interpretation must be conducted in a timely fashion to assure remedial action at as early a date as possible.

Attention will be paid to current synchronous spacecraft and related charging effects. Coordination and planning will be carried out with AFGL and non-AFGL SCATHA experimenters. Coordination with other, similar satellites, will be attempted with a view toward coordinated studies during the SCATHA mission in 1978.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0007, GEODETIC LASER RANGING
R.W. KING, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249310)

AF function - strategic weapons delivery. Objective - to investigate the use of precise extraterrestrial measurement techniques (lunar and satellite laser ranging and very-long baseline interferometry) to determine basic geodetic parameters. How research contributes - intercontinental geodetic ties, earth rotation and polar motion must be determined with improved resolution and reliability to attain projected ICBM accuracies over the next decade. These parameters affect the g g (geodesy and geophysics) and G&C (guidance and control) CEP's (circular errors probable) of Minuteman III and M-X.

Data from laser ranging observations of the moon and the laser geodetic satellite (LAGEOS), and data from very-long-baseline interferometric (VLBI) observations of extragalactic radio sources will be analyzed to determine earth rotation, polar motion, and solid-earth tides.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LW, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0008, TECHNIQUE DEVELOPMENT FOR SOON DATA UTILIZATION AND PREDICTIONS OF SOLAR-INDUCED ENVIRONMENTAL DISTURBANCES
D.F. NEIDIG, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249460)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - assist the Air Weather Service in improving the monitoring and prediction of disturbances and study coronal holes and their relations to the geomagnetic index. How research contributes - this work unit is concerned with the instrumentation and techniques necessary for the detection and prediction of solar flares.

Members of the AFGL contingent at SPO will work closely with the Air Weather Service and ESD to give technical assistance during contract production of the SOON system by the National Science Foundation at SPO and by NAFI. When the first production telescope is installed at Holloman AFB, the Branch will begin standardization and debug tests on the videometer instruments at Holloman and Palehua. To improve the reliability of A-sub-P predictions, two efforts will be undertaken. first, present analysis programs using Fe 5303 (greenline) observations from the 40-cm coronagraph will be refined and modified to convert this project from a complex research task to an automatic data reduction routine. Second, branch personnel will give technical assistance to NSF personnel at SPO on construction of the one-shot coronagraph, which will provide additional data for the A-sub-P analyses when completed. It will then be used by Branch personnel in full-limb observations.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0009, PARTICLE EFFECTS ON SPACE SYSTEM SURVIVABILITY
P.L. ROTHWELL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248920)

AF function - reliability, cost-effectiveness, lifetime and survivability of operations space systems. Deficiency - knowledge of the energetic particle environment necessary to adequately predict the reliability and lifetime of space systems. Objective - to determine the transient and steady-state energetic particle environment and to indicate possible effects on spacecraft performance and lifetimes. How research contributes - an extended data base from AF satellites will be used to construct realistic

static and dynamic models of the near-earth particle environment.

The energetic particle environment in the near-earth space causes radiation damage to system components and hence shortens their lifetimes. This work unit will utilize an extensive data base obtained from several satellites to define the relevant energetic particle environment. Transient effects occurring during magnetic substorms can cause temporary system malfunctions. Electron data from the DMSP satellite will be used to examine acceleration events further up the field line and to correlate these events with system anomalies.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0010, STUDY OF ENERGY BALANCE AND PLASMA MOTIONS IN THE IONOSPHERE

A. DALGARNO, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (DF248310; F19628-77-C-0030)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of energy balance and plasma motions in the ionosphere for the design of AF communication and navigation systems. Objective - development of theoretical and computational techniques for the calculation of quantities pertaining to the energy balance and plasma motions in the ionosphere including the effects of particle precipitation and electric fields. Satellite measurements shall serve as inputs to the calculations and as a test of the validity of the theory. How research contributes -provides data and analysis essential for the design and maximum utilization of communications, guidance and surveillance systems such as the Defense Satellite Communication System, AF SAT COM II, 414I. The work provides an understanding of the dynamical processes in the ionosphere.

Study theoretical and computational procedures for calculation of energy balance, plasma motions and electrical conductivities on a global basis.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0011, ANALYSIS OF STRATOSPHERIC TURBULENCE MEASURED BY RADAR

R.K. CRANE, Environmental Res. & Tec. Inc., *Concord, Massachusetts* 01742 (DF248170; F19628-77-C-0059)

AF function - environmental impact statements of high-altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere may deposit harmful material and it is important to be able to assess the dispersion and residence time of such material in the stratosphere. Objective - develop an experimental time history of the evolution of radar measured stratospheric turbulence, coupled with an analysis of simultaneously obtained radiosonde data for estimates of eddy diffusion rates and eddy diffusivity. How research contributes -the AFGL model for vertical transport of pollutants out of the stratosphere by turbulence is based on the assumption that the turbulent layers form and decay randomly in time and randomly in space. This work provides the data base to test this hypotheses. In addition, this work will provide an independent estimate of the effects of turbulence on vertical transport based on radiosonde data.

Turbulent structure in the stratosphere can be detected by radars of sufficient power and sensitivity. This remote sensing technique permits continuous monitoring of the stratosphere and the growth and decay of turbulent layers. Existing data covers several hours of continuous monitoring for each observation and with many observations for various seasonal conditions. Also available are concurrent radiosonde measurements. Analysis and interpretation of the radar and radiosonde data will provide information on the growth and decay rates and the horizontal extent of horizontal turbulent layers, estimate of energy dissipation rates and eddy diffusion coefficients. The data will be applied to experimentally verify a model which estimates vertical transport rates. This will assist in the determination of the residence time for pollutants deposited in the stratosphere by Air Force operations.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0012, INTERFEROGRAM DATA ACQUISITION SYSTEM FOR BALLOON BORNE CRYOGENIC INTERFEROMETER

J.L. PRITCHARD, Idealab Incorporated, *Franklin, Massachusetts* 02038 (DF248480; F19628-77-C-0039)

AF function - surveillance, advanced infrared detection system. deficiency - lack of high-resolution data of stratospheric emittance in infrared. Objective - to acquire and handle interferogram signal from cryogenically operated interferometer in balloon-borne environment. How research contributes - an instrument sensitive enough to measure stratospheric emission will be made ready for a balloon-borne operation.

A system for acquiring and handling an interferogram signal from a cryogenically operated high-resolution ir interferometer will be designed and fabricated. Tests for interfacing will be conducted to see whether the full sensitivity of the instrument will be achieved to insure a detection of the stratospheric emission for a proposed balloon-borne experiment.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0013, INSTRUMENTATION ANALYSIS DESIGN AND FABRICATION OF SYSTEMS FOR AIR FORCE PROGRAMS

A.H. HOWELL, Tufts University, School of Engineering, *Medford, Massachusetts* 02155 (DF248700; F19628-77-C-0047)

AF function - balloon instrumentation analysis and design. Deficiency - lack of Air Force expertise and experience in azimuth stabilization systems and air launch balloon systems. How research contributes - the engineering, analysis and design supplements similar support provided by AFGL to other government agencies.

Conduct research to provide an air-launched balloon system instrumentation design and provide consultation and analysis of a balloon-borne telescope system using a stabilized platform for project bamm.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LC, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0014, THEORETICAL STUDY OF PLASMA EXCHANGE BETWEEN F-REGION AND MAGNETOSPHERE

D.G. TORR, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (DF248710; F19628-77-C-0007)

AF function - ionosphere and magnetosphere modelling and prediction, communication, surveillance, navigation. Deficiency - inadequate knowledge of interaction between different ionospheric constituents and of equations governing their transport at all altitudes. Objective - to model the motion of different ionospheric ion species along and across magnetic field lines at low- and mid-latitudes. How research contributes - the new code will give a means of predicting changes in relative abundance, density and motion of ionospheric and magnetospheric constituents at mid-latitudes. This will improve understanding of and prediction of plasma depletion and irregularities in the ionosphere which degrade performance of AF communication and surveillance systems whose ray paths traverse mid-latitude ionospheres.

A computer code will be constructed to model the motion of ionospheric ions using newly developed computational techniques which allow independent treatment of different ion species over a range of solar-geophysical conditions.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0015, NAVY ENVIRONMENT - MARINE FOG MODELS

J.W. TELFORD, Univ. of Nevada System, Desert Research Institute, *Reno, Nevada* 89507 (DN223763; N00014-75-C-0598)

The objective of this research is to formulate a marine fog forecasting model that will include a sufficient understanding of the importance of both an increasing and a decreasing temperature gradient at sea so that the fog model can be applied to longer trajectories of ocean air movement across latitude lines. The model is sought for better environmental support of naval operations at sea.

An extensive set of observations in the marine boundary off the west coast collected by the principal investigator over many years will be used to test theoretical concepts to be incorporated in the model. These theoretical concepts concern what happens to an air mass as it moves northward over colder water or southward over warmer water.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0016, PREVENTION AND CONTROL OF ICE ADHESION

G. ASHTON, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DA0D8141)

Develop methods of control, prevention, and alleviation of accretion and adhesion on current and future Army helicopters and other materiel where ice accretion prevents or interferes with all-weather operational capability.

A standardized test will be developed to evaluate the adhesive strength of ice to allow comparative evaluation of the relative merits of candidate materials proposed as ice phobic. Mechanisms of ice accretion as influenced by the parameters of liquid water content, droplet characteristics, air velocity and temperature, as well as characteristics of the accreting structure such as size and shape will be examined in wind tunnel simulations. Methods of applying energy to ice-substrate interfaces will be examined via analytical and experimental means. Distribution of icing conditions as affected by geography and elevation will be examined to evaluate the influence of icing on various operational modes such as nap-of-the-earth operations. Cognizance of related industrial research and foreign developments will be maintained.

ADDENDA: Supporting agency address is: OCE Cold Regions Research and Engineering Laboratory, PO Box 282, Hanover, NH 03755

SUPPORTED BY U.S. Dept. of Defense, Army

5.0017, ADHESION AND PHYSICS OF ICE

D. ITAGAKI, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DA0D8151)

To provide fundamental knowledge of the mechanisms and properties of ice adhering to surfaces of fixed and rotary-wing surfaces as well as other surfaces where the accretion and adhesion of ice interferes with the operation of materiel. To establish basic principles involved in the development of methods and techniques to remove ice from surfaces. To explore and develop means to prevent and/or alleviate icing. To evaluate and predict incidence and intensity of icing on the basis of readily available meteorological parameters.

The required information will be generated by a coordinated sequence of investigations including microscale evaluation of the physics and properties of ice adhering to interfaces, examination of the mechanisms of crack propagation in ice near an interface, and investigation of the interrelationships and influences of electrical properties on the mechanical properties of ice. Studies will also be pursued to determine in more detail the actual mechanism of accretion with attention centered on the freezing process of small droplets from the time they first impact to the time when they are frozen (accreted) or removed by the ambient air stream. Information developed will be disseminated to users and other project participants to provide a basis for improved design and performance of materiel. Foreign state-of-the-art is being considered.

ADDENDA: Supporting agency address is: OCE Cold Regions Research and Engineering Laboratory, PC Box 282, Hanover, NH 03755

SUPPORTED BY U.S. Dept. of Defense, Army

5.0018, MARINE FOG INVESTIGATION

R.J. PILIE, Calspan Corporation, *Buffalo, New York* 14221 (DN590184; N00019-76-C-0657)

The objective of this investigation is to improve the understanding of the phenomenon of fog at sea. This understanding is necessary to improve the ability to forecast the occurrence of fog at sea and to develop techniques to control fog, that is, to dissipate or create it.

An at-sea measurement program is being conducted during the life cycle of fogs. Atmospheric data to be acquired fall into three categories: fog microphysics, micrometeorological data, and aerosol characterization. Collectively, these data will provide detailed life histories of important fog properties and air mass characteristics. Oceanographic measurements will be made concurrently to gain an understanding of air-sea interaction influences. To date, measurements have been made off the coast of northern California and south of Nova Scotia. Under this contract measurements will be made off the coast of southern California.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense, Navy

5.0019, WIND-TUNNEL TEST AND LABORATORY EVALUATION OF PHOTOIONIZATION PROBE

L.C. HALE, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (NSG 7350)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0020, PREPARATION OF AGROPHYSICAL MAPS

F.C. WESTIN, South Dakota State University, School of Biol. & Agric. Sci., *Brookings, South Dakota* 57006 (NAS 9-15345)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0021, BIOLOGICAL AND ECOLOGICAL EFFECTS OF ENERGY TRANSMISSION BY MICROWAVES - EFFECTS OF 2.450 MICROWAVE ILLUMINATION ON PLANT GROWTH

C.H. WARD, Rice University, Graduate School, *Houston, Texas* 77001 (NAS 2-9552)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0022, DYNAMICS OF THE HIGH-LATITUDE IONOSPHERE

W.J. RAITT, Utah Higher Education System, Graduate School, *Logan, Utah* 84321 (DF248300; F19628-77-C-0011)

AF function - surveillance, communication navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of plasma flows, charge distributions, electric fields for the design needs of AF systems. Objective - study high-latitude ionospheric dynamics in three areas: 1. High-latitude f-region dynamics, 2. Convection electrodynamics, and 3. Polar wind. How research contributes - provides data essential to HF and UHF propagation predictions, provides data required for the design and utilization of communication guidance and surveillance systems and provides understanding of the dynamical processes in the ionosphere.

Develop theoretical procedures and computer codes to determine plasma flow, particle distributions and effects of electric fields on the high-latitude f-region. Satellite data will be utilized to test the theoretical methods and to develop a prediction capability for the high-latitude ionosphere.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

5.0023, MULTI-IMAGE INTERPRETATION TECHNIQUES TESTS
T.C. VOGEL, U.S. Army, Geographic Info. Systems Div., *Fort Belvoir, Virginia* 22060 (DA0L8107)

Evaluate existing and developmental imagery sensor outputs through conventional techniques, and develop equipment and man-interactive automated techniques to extract and process essential terrain and topographic data for factor overlays, MGI, and topographic data bases. Document the conventional techniques and use the resulting performance baseline and outputs for comparison to automated techniques developed with the ETL experimental Automated Image Data Extraction System (AIDES).

Conduct in-house quantitative image interpreter tests utilizing aerial imagery acquired with conventional and non-conventional systems (multispectral and multiband images) and evaluate the effectiveness of acquisition systems for collection of MGI terrain data. This will form the base level for input images, human interpretation and development of automated interpretation techniques for comparative analysis. Feedback from these efforts will provide the basis for identification of machine-assisted processing, conceptual design of electrooptical interpretation devices, and for updates of the sensor matrix study, technical reports and draft input to Army FM and TM publications.

ADDENDA: Supporting agency address is: OCE ETL Geographic Information Systems Div, GSL, Ft Belvoir, VA 22060

SUPPORTED BY U.S. Dept. of Defense, Army

5.0024, STUDIES OF SOUNDINGS AND IMAGING MEASUREMENTS FROM GEOSTATIONARY SATELLITES
V.E. SUOMI, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (NAS 5-24136)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

5.0025, THE INFLUENCE OF AEROSOLS ON ELECTRIC PARAMETERS IN THE FREE ATMOSPHERE 14048-GS
D.J. HOFMANN, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DA0F8900; DAAG29 77 G0046)

To assess the degree of influence that the natural aerosol in the stratosphere has on electrical parameters such as ion density and conductivity. Relevance - the work directly supports research programs at the Atmospheric Sciences Laboratory and the Ballistic Research Laboratories relating to atmospheric effects upon communications, the high-energy laser and ballistic missile defense systems.

Construct a new and better instrument to reliably measure ion density from a balloon-borne platform to be launched from Laramie station (41 degrees N). This new instrument, plus a dustsonde, will be used to make simultaneous balloon-borne soundings of small ion density and the aerosol concentration in the stratosphere. The corresponding structure and variation in the two profiles will be analyzed.

ADDENDA: Supporting agency address is: Darcom Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense, Army

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, MEDICAL RESEARCH OF OPERATIONAL PROBLEMS IN ARMY AVIATION
F.S. PETTYJOHN, U.S. Army, Aviation Medicine Res. Div., *Ozark, Alabama* 36360 (DA0B6894)

To provide the US Army information and recommendations for protection of aviator health from medical hazards encountered in operational Army aviation.

To apply accepted medical research methods in Army aviation to fulfill the above objective.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Laboratory, Ft Rucker, AL 36362

SUPPORTED BY U.S. Dept. of Defense, Army

6.0002, COST ANALYSIS OF VISUAL MOTIONS SYSTEMS OF ASUPT
M.J. FIERO, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223130)

To develop cost factors and associated cost estimates of the Advanced Simulator for Undergraduate Pilot Training (ASUPT) visual and motion systems (VISMOS). These results in conjunction with effectiveness data obtained from another study will serve as the basis for a cost-effectiveness analysis of VISMOS for future simulators including an advanced version of Air Training Command Instrument Flight Simulator (ATC/IFS).

Using both the cost factors approach and parametric analysis, life-cycle costs (i.e., R&D acquisition, and O&S) estimates will be obtained for the VISMOS of two categories of simulators (1) an advanced version of the IFS and (2) another future simulator. More specifically, cost estimates of the VISMOS of both categories of simulators will include the following configurations: (1) full platform motion and full (ASUPT) field-of-view, (2) full platform motion and narrow (ATC/IFS) field-of-view, (3) no platform motion and full field-of-view, and (4) no platform motion and narrow field-of-view. Full platform motion and full field-of-view (7CRTS) are represented by normal ASUPT configuration while the narrow field-of-view, the present ATC/IFS visual system, is simulated by using only one of the ASUPT CRTs. This study will parallel a training effectiveness research effort directed at establishing the contribution of the variously configured VISMOS to the transfer of training from flight simulators to aircraft (1123-03-28). The results of this study and 1123-03-28 will be used in a cost-effectiveness analysis of simulator VISMOS. Standard statistical techniques will be used in conjunction with historical cost data, manufacturer's prices, cost factors manuals data, and data from other sources (including CERS) to develop LCC estimates. Lt Col F. Nordhauser will serve as a consultant for this study.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTT, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0003, CONTRIBUTION OF SIMULATOR PLATFORM MOTION IN AIR-TO-SURFACE WEAPONS DELIVERY TRAINING
T.H. GRAY, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223110)

To determine: 1. the extent to which generalized, conventional, air-to-surface (A/S) weapons delivery training in the Advanced Simulator for Undergraduate Pilot Training (ASUPT) transfers to a specific aircraft, and 2. the contribution of six degree of freedom platform motion to the transfer of training from simulator to aircraft.

Twenty-four students in the lead-in A/S training course at Holloman AFB will serve as subjects. These subjects will progress through lead-in training, receiving all training except the A/S flights. The subjects will then proceed to Williams AFB where they will be assigned to experimental and control groups. At Williams, all subjects will receive academic training in weapons delivery techniques and procedural training on F-5B operations. At this point, the students in the control group will fly two data collection sorties in the F-5B aircraft, performing 10 degrees, 15 degrees, and 30 degrees bomb deliveries, instructor ratings will be taken. The experimental groups will receive A/S weapons delivery training in ASUPT on 10 degrees, 15 degrees, and 30 degrees bomb deliveries using a fixed number of trials on each event to examine learning. At the end of this training, each subject will be given two ASUPT checkrides structured like those in the aircraft. The experimental subjects will then receive two-data collection flights in the F-5B identical to those received by the control group. Aircraft performance of all three groups will be compared and analyzed to determine the contribution of motion to training and the extent that generalized A/S simulator training transfers to the F-5B aircraft.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTS, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0004, AUTOMATED MEASUREMENT FORMATION FLIGHT TRAINER

G.B. REID, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223270)

To develop and evaluate a performance measurement system to automate data collection in the Formation Flight Trainer (FFT). The resulting software and data base will be broad enough to be used in constructing a measurement system for formation flight in the Advanced Simulator in Pilot Training (ASPT).

A measurement system will be developed that will model instructor pilot (IP) evaluation. This will be accomplished by testing the ability of both students and IPs to fly the FFT. During these data runs, performance will be recorded by the Automatic Data Acquisition and Control System (ADACS) and two IP evaluators will independently rate performance. The IP data and the combined data base will be used to develop a prediction equation using the IP evaluator grades as a criterion.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTS, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0005, ACQUISITION OF FLYING SKILLS

G.B. REID, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223280)

To investigate the relationships which exist in pilot training between stage of training, training task structure, and feedback of information.

Simulation devices will be used to investigate training variables in order to develop a model of flying skill acquisition. Studies will be conducted to investigate such things as length of training sorties, fidelity of training task related to criterion task, subject experience and interaction with aircraft sorties.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTS, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0006, EFFECTS OF AIR FORCE POLLUTANTS ON VERTEBRATE CELLS IN VITRO

M.W. BERNS, Univ. of California, School of Biological Sciences, *Irvine, California* 92664 (DF046230; AF-AFOSR-3136-77)

AF function - the Air Force uses many unique chemicals and materials to obtain optimum performance for its aircraft and missiles. These chemicals and materials or their byproducts impact on the surrounding environment with varying degrees of severity on both a short- and long-term basis. Legislative and regulatory controls mandate that the Air Force is responsible for assessing and controlling pollution in its operations. Deficiency - rapid and accurate test systems are needed. A system is required that permits extrapolation to the real-world situation. Objective - the purpose of this research is to develop in vitro an assay system for the evaluation of various environmental pollutants while obtaining a basic understanding of some of the mechanisms of agent action at the cellular level. How research contributes - the research directly supports subarea 1.5 'Toxic Hazards' and 1.9 'Environmental Quality'. Results could lead to controlled usage of known harmful agents and development of agents that have the same operational efficiency but with minimal biological effects.

Vertebrate cells in culture will be exposed to various agents and assayed for growth effects, chromosome effects, ultrastructural alterations and changes in cell behavior.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0007, DEVELOPMENT OF OPERATIONAL AUDITORY PERFORMANCE STANDARDS FOR NAVY AVIATION PERSONNEL

J.D. MOSKO, U.S. Navy, Acoustical Sciences Division, *Pensacola, Florida* 32512 (DN777307)

The objective of this proposal is to develop a workable set of psychoacoustic standards which reflect the operational requirements for the human auditory system over a broad spectrum of naval aviation tasks.

The program of research to be conducted will be based on the role of the auditory system in relation to the overall task performance. The requirements for the auditory system will be derived from a simple operational model of task performance. Inputs to the model will come from: (1) compilation and analyses of operational tasks; (2) description and analyses of operationally relevant auditory sensory inputs and relevant auditory processing requirements; (3) description and analyses of environmental and psychophysiological factors which influence auditory performance; and (4) laboratory and field experiments with operational personnel to confirm the applicability of the psychoacoustic standards.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Laboratory, Pensacola, Fla. 32508

SUPPORTED BY U.S. Dept. of Defense, Navy

6.0008, DYNAMIC RESPONSE OF VERTEBRAL ELEMENTS RELATED TO USAF INJURY

J.F. LAFFERTY, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (DF046790; F49620-77-C-0043)

AF function - effective ejection of aircrew members from high-speed aircraft requires the maximum acceleration permitted by human tolerance. This implies the optimal combination of restraint and orientation, seat configuration and acceleration profile. Deficiency - observations indicate that most of the irreversible damage sustained during ejection is related to the vertebral column. Knowledge of the dynamic material properties of the spinal elements is lacking. Objective - this research will determine the load distribution and stress strain characteristics of the vertebral joints normal and at right angles to the spinal axis. How research contributes - the tests proposed are unique and will integrate into the AMRL program dealing with vertebral unit strength and interspecies scaling relationships. Results will provide previously unavailable data on spinal column strength. This research is identified in subarea 1.6 'Mechanical Forces'.

Stress-strain characteristics will be determined as a function of strain-rate for shear, bending, torsion and tension.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0009, THE DEVELOPMENT, MAINTENANCE, AND MATHEMATICAL DESCRIPTION OF TRACKING BEHAVIOR

D.F. MCCOY, Univ. of Kentucky, School of Arts & Sciences, *Lexington, Kentucky* 40506 (DF039880; AF-AFOSR-2751-75)

AF function - environmental stresses which affect aircrew members during operations include noise, high temperatures, acceleration and vibration. These effects are seen as alterations of physiological function and general decrements in performance capabilities. Deficiency - an understanding of the effects of environmental stresses on human performance is essential for specifying man-machine system design and for predicting mission effectiveness. Objective - laboratory studies with human subjects are often compromised since a limited range of stresses can be employed. One alternative is to develop a series of tasks similar to those of aircrew members and train subhuman primates to perform such tasks. This offers the unique feature of allowing application of stresses at all levels and enables certain surgical manipulations which afford access to the physiological and biochemical factors of performance decrement. This project is an integrated approach to compare and contrast compensatory and pursuit tracking in terms of training techniques and appropriateness of specific mathematical models, devise the tasks, learning methodology and mathematics for discrete interaction with the tracking tasks and address the problems of validity and reliability of animal-to-man extrapolations with the most promising of the resultant models. Relevance - this project is in direct support of ongoing USAFSAM/RAW programs and will help elucidate involved fundamental mechanisms.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0010, INVESTIGATION OF CERVICAL SPINE DYNAMICS

Y.K. LIV, Tulane University of Louisiana, Graduate School, *New Orleans, Louisiana* 70118 (DF320340; F33615-76-C-0526)

The objective of this effort is to provide anatomical, structural and loading data on the human cervical spine for incorporation as part of a biological parameter data set into the dynamic head-spine computer model presently at AMRL/BBM. The data generated will improve the analytic predictive capability provided by the above-mentioned model by allowing detailed analysis of head-spine response (including potential injury assessment) during ejection from aircraft, aircraft crashes or other high-level impact loading of the human body, and while taking into account various external body constraints and head encumbrances.

A literature search for previous work, both experimental and theoretical, in the area of cervical spine dynamics will be performed. Segments of at least six human cervical spine specimens will be tested statically, dynamically and to failure for their axial, anterior-posterior and lateral loading characteristics. Care will be taken to ensure appropriate specimen selection to provide structural and loading data as characteristic as possible of Air Force flight personnel.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0011, DEVELOPMENT AND APPLICATION OF A TASK TAXONOMY FOR TACTICAL FLYING

R.P. MEYER, Design Plus, *St. Louis, Missouri* (DF223300; F33615-77-C-0020)

To develop a procedural methodology which TAC operational training personnel can use in the construction of continuation training programs for aircrews and to investigate the relationship of specific behaviors to the proficiency of aircrew skills. The product of this effort should provide reliable procedures for determining and structuring the content of aircrew continuation programs.

Application of a flying task taxonomy developed for TAC aircrew skills will be used. Taxonomic methodology will provide a conceptual structure for classifying flying training tasks into skill groups for comparison of inter-task relationships.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FT, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0012, SCANNED LASER VISUAL DISPLAY SYSTEM DEVELOPMENT

D.W. ANDERSON, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228300)

To develop a design for a wide-angle, multi-viewer infinity display system for use in visual simulation. Current multi-viewer display systems provide a relatively narrow field-of-view. State-of-the-art wide-angle displays are limited to only one viewer. With this effort, the technology to provide a continuous wide-angle, color infinity image to the cockpit crew in a flight simulator will be investigated. A display system based on the initial design effort is intended to increase the number of missions which can be trained in simulators for bomber-, cargo-, and tanker-type aircraft. The purpose of this work unit is to document the in-house portion of the R&D.

A scanned laser visual system is presently being developed by the Army Training Device Agency under contract. The system has the potential to solve many of the problems associated with wide-angle, multi-viewer displays. Funds will be transferred to the Army to allow the expansion of the current contract effort to study and design a special optical element (SOE) which is the key element in creating an infinity display making use of the high-intensity raster scanned laser. Samples of various types of potential SOE's will be procured to facilitate study of manufacturability and choice of final design. In addition, a study will be made of modifications required in current computer image generators to permit interface with the scanned laser visual display system.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0013, VCS APPLICATIONS

J.H. BRINDLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321180)

The purpose of this work unit is to develop and evaluate advanced integrated control/display concepts and equipment applicable to real-time reconnaissance and weapon delivery functions. This effort combines the utilization of operator-centered control and display technology to provide integrated optimized operator interfaces with selected weapon subsystems. Systematic evaluations of the concepts are performed to determine the overall utility and performance of advanced state-of-the-art control and display concepts as they are applied to advanced reconnaissance and weapon delivery systems under development. Areas of study will include the use of the head and eye to direct fire control systems, provide weapon systems guidance, control reconnaissance systems and select display information. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, and PMDR-P2033(5)64708F/5973, Visual Coupling Aids.

Several specially configured test-bed aircraft associated with specific test projects will serve as the airborne testing facilities. In most cases a slewable sensor/designator will be interfaced with helmet-mounted sight/display systems. Sensor imagery can be presented in either helmet-mounted or panel-mounted display modes, coupled with joystick and/or helmet-mounted sight control of the sensor/designator. The interactive use of symbology with sensor imagery will be investigated where appropriate. In addition, ground vibration tests will be conducted to identify the characteristics of vibration induced error in helmet-mounted sight tracking. From this data, matched filters will be developed to reduce a significant portion of the tracking error experienced in airborne missions. The integration of HMS/D systems and symbology generation systems along with system software development will be accomplished for concept demonstrations of the hemispherical HUD, visual communications and cueing/designation. This work unit, in part, encompasses work previously performed under work unit 7184-04-44, Control/Display Integration and Evaluation.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0014, PROJECT 5973 SUPPORT

J.H. BRINDLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321190)

This work unit will continue to support project 5973, Development of Visually Coupled Aids, with technical support following transition of the engineering development program to ASD/AE. This support, in accordance with transition guidelines, will include both technical and human factors inputs to the hardware development as well as the test and evaluation phases of the program. Through such inputs the program will be provided with necessary technological advances, performance measures on candidate VCS subsystems, and interface criteria for VCS components in various applications testing. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, and PMDR-P2033(5)/64708F/ 5973, visual coupling aids.

Promising VCS component technology will be developed to the point where it can be incorporated into the 6.4 program in ASD/AE. Technical and human factors inputs will be provided to test efforts such as Single Seat Attack (SSA), Visual Aided Tracking System (VATS) and project Quick Strike. This includes support for both ground-based simulation as well as flight testing. Measurement data on various VCS component capabilities will be provided using the image metric laboratory and, in some cases, final acceptance testing of deliverable systems will be performed. Helmet integration of VCS components will be pursued and basic helmet development and interface work will be applied where appropriate. Methodology for providing an efficient, timely flight test support capability will be evolved and coordinated with ASD/AE on a regular basis.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0015, APPLICATION OF VISUAL SYSTEM MODEL TO AIR FORCE PROBLEMS IN PATTERN RECOGNITION
M.W. CANNON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321530)

A need exists in the Air Force for hardware systems that can aid and/or replace human operators in certain phases of reconnaissance imagery analysis, surveillance and target detection. The objective of this work unit is to: (1) develop techniques to aid the human operator in visual detection and recognition tasks, and (2) to investigate design principles for automatic systems by which the task would be more efficiently performed without man's intervention.

Two aspects of the visual man-machine interface problem will be given special emphasis. (1) Techniques will be developed for determining by a computerized procedure the confusability of cockpit display symbol sets and for designing symbol sets with minimum confusability among symbols of the set. (2) Adaptive pattern recognition techniques and the form-recognition capabilities of the visual system model will be combined to investigate the enhancement and recognition of targets in reconnaissance imagery. These techniques will be used to demonstrate automatic navigation systems which can locate and identify targets from radar or visual imagery without human intervention. The form-recognition capabilities of the visual system model will also be applied to the analysis of target form distortion by aircraft windscreens.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0016, REQUIREMENTS FOR PLATFORM MOTION CUEING IN CARGO AIRCRAFT SIMULATION
T.E. COTTERMAN, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228290)

To determine the value of motion cues in training pilots for flight operations in cargo aircraft. The utility of such cues will be established relative to various maneuvers and situations for both transitioning and experienced pilots.

Pilots will be given training in the operation of the C-130E aircraft in the NASA-Langley visual-motion simulator which provides 6 degree of freedom platform motion and a 48-degree REDIFON color visual display. Pilots will be systematically exposed to different training cues - motion or out-the-window visual, both of these cues, or neither of these cues. After training, the pilots' relative proficiencies will be evaluated in both the simulator and in the aircraft to determine the effect of the respective training cues. Evaluation criteria will include regular Stan/Eval ratings, supplemented by additional expert judgments, and selected flight parameters recorded in the simulator for off-line analysis. Milestones - checkout and verification of simulation equipment, 1 March 77, data collection complete, 1 July 77, data analysis complete, 1 Sep. 77, draft study report, 1 Nov. 77.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0017, VISUAL PERCEPTION THROUGH WINDSCREENS
F.E. GOMER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321120)

To relate the optical characteristics of aircraft forward transparencies to specific aspects of visual performance. F-111 and B-1 windscreens, as well as transparencies with new geometric configurations will be evaluated. Optical deficiences include distortion, binocular disparity, multiple imaging birefringence coloration and transmission loss. The ultimate goal of this work unit will be the development of a set of visual perception measures to be used in acceptance testing of aircraft windscreens. These measures will influence the selection of optical tests. Data collected under this work unit using these measures will form the basis for setting of optical specifications. This effort supports AFSC development goal MS-4 and TN-ASD-AMRL-0602-72-56, minimum vision requirement for transparancies.

Through ground-based laboratory experimentation, this research program will be directed toward the determination of performance limiting changes in visual perception produced by optical deficiencies in aircraft windscreens. Results will be interpreted with respect to measures of windscreen optical quality. Examination of the effects of optical distortion requires tests of: (a) visual acuity, both static and dynamic, (b) motion perception in terms of movement thresholds, velocity estimations, and two-dimensional eye-tracking accuracy, (c) distance perception with respect to static and dynamic targets, and (d) depth perception, both near- and far-field. The distracting influence of multiple imaging will be investigated by monitoring three-dimensional eye-tracking accuracy, while birefringence coloration effects will be determined by measuring the changes in accommodation that are produced. For all testing situations, short-term viewing influences will be differentiated from long-term viewing influences. Visual quality inspection process will be categorized, psychometrically quantified and related to optical, pilot and laboratory performance measures.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0018, OPERATOR HEAD/EYE CONTROL CHARACTERISTICS
J.P. HORNSETH, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321040)

The main thrust of this work unit will be to determine the conditions under which it is desirable to use the head or eye for manned and unmanned aircraft piloting, weapon delivery, and sensor control. The research effort will concentrate on determining the natural characteristics of hand, head, and eye tracking, including the effects of environmental stressors on these characteristics. An integral component of the research will be the effects on control performance of image format and location in the visual field of displayed feedback and secondary task information. The results will provide data required for the selection and specification of control-display systems proposed for operational applications. The research will also identify promising new techniques of harnessing the operator in control task situations and suggest further development or prototype application and evaluation.

Experimentation will be conducted in a fixed-base laboratory and in simulated flight environments incorporating vibration and gz stressors. When practical, data from complementary in-flight tests will be used to validate the ground-based results. Operator control performance with a hand controller, the helmet-mounted sight, and the oculometer will be investigated to establish a data base of operator pointing accuracies and frequency response which will document the performance tradeoffs for hand, head, and eye controllers. Concurrent experimentation on a vibration simulator will begin to quantify the effects of a buffeting environment on head control and seek to develop software techniques to compensate for errors induced by the head rotational system's vibration transmissivity. Experimentation to be conducted on the AMRL centrifuge will compare hand, head, and eye control performance under gz acceleration to determine the mode of response that is best for an operator to use in aiming the fire control system in a high-performance aircraft. Additional laboratory experimentation will explore natural head-eye coordination. The results will influence the design of the helmet-mounted sight reticle and the development of a helmet-mounted oculometer. This effort was previously reported under work unit 7184-04-43, Control Concept Development.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0019, PERFORMANCE MODEL OF REPETITIVE G EFFECTS ON AIR COMBAT EFFECTIVENESS
W.H. INGE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322540)

Primary objectives are: (a) to obtain data on human operator performance during and following exposure to repeated high G stress, (b) to measure associated physiological parameters, and (c) to formulate a model of human operator performance under repetitive acceleration in order to predict operator effectiveness in high-performance aircraft under combat conditions. These ob-

jectives are part of an ongoing USAF effort to examine air-to-air combat tracking scenarios and mathematically describe the human pilot in order to improve fighter tactics and aircraft design (TAC Avenger).

Human subjects will be exposed to standard repetitive G profiles on the AMRL dynamic environment simulator in a closed loop tracking task. Their tracking errors during the task will be recorded to provide modeling data. Several standard stress-related physiological measurements will be made, including pulmonary function tests, blood chemistries, and blood-formed elements. The results will be examined for clues to physiological mechanisms related to performance decrements under acceleration stress.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0020, FAILURE CHARACTERISTICS OF SPINAL ELEMENTS

L.E. KAZARIAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321440)

Spinal injury continues to be a problem associated with ejection from USAF aircraft. This investigation is being carried out in two phases in order to provide a qualitative and quantitative basis for modeling actual operational vertebral injuries. The initial phase of this investigation deals with the identification and classification of spinal injuries. The second phase is an experimental investigation to provide for the first time quantitative data on the nature of the local response of spinal vertebrae to complex mechanical loads and formulation of clinical methodology for recognition of these spinal injury patterns.

Results of past and present studies on spinal impact loading experiments will be scrutinized to identify mechanisms of failure. Similarly, clinical records involving spinal injuries will be studied to examine the structural mechanisms of the particular types of injuries identified. Additional experiments will examine the isolated vertebral central under compressive loading at three different strain rates. The results of this effort will assist the formulation of a new mathematical model under RTE 3-H-3 depicting the structural, mechanical and material property response of isolated vertebral elements encompassing their rate-dependent and nonlinear characteristics. These data will also provide a quantitative basis for increasing allowable load transfer levels to man by impact loading during ejection from aircraft.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0021, DESIGN AND EVALUATION OF WORK STATIONS

K.W. KENNEDY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320960)

New AF manned systems require crew and work station designs that represent departures from those seen in current systems. The purpose of this effort is to derive pilot and crew body-size and biomechanical data to guide the design of crew stations and of ground support work stations. Much of this information will be used to derive new military standards to guide the design and evaluation of crew station geometries. Attention is given to safe and efficient accommodation of the variability of body sizes, proportions, and mobility characteristics, whether lightly clad or encumbered by protective equipment, and whether flying or working in normal or stressful environments.

Body size, body clearances, arm- and leg-reach capabilities, and vision envelopes are measured on subjects representative of AF personnel. Effects on these measures by varing body supports, i.e., seat back angles 10 to 75 degrees, and different environmental stresses, i.e., two to 11 gs are examined. Cockpit geometry standards will be developed during FY 77 and 78 to specify the layout of controls, design of body supports and escape envelopes of advanced systems. Three-dimensional analyses of 5th, 50th, and 95th percentile reach envelopes for men and women will be completed for the seated position (13 degree back angle, 6 degree seat) during FY 77. Analyses for back angles of 10 degrees, 20 degrees, and 30 degrees and the technique to reconstruct the reach envelopes for any back angle between 10 degrees and 30 degrees will be developed during FY 77. Effects of encumbering personal-protective equipment on these measures are also evaluated. Interact with other federal agencies on programs of mutual interest. Provide consultation and support in research primarily of interest to other federal agencies.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0022, PHYSIOLOGICAL RESPONSE OF PLANTS TO MISSILE EXHAUSTS

C.T. LIND, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320810)

To define the adverse effects of missile exhaust components on the physiological functions of plants. The mechanism of physiological damage due to phytotoxic exhausts is investigated. Initial concern is directed toward hydrogen chloride gas which results from solid propellant rocket motors used in the Titan launch vehicle. Hydrogen fluoride and other potentially phytotoxic exhaust gases are investigated as necessary.

To review pertinent literature for determining adequate laboratory and field methods for measuring various plant functions. Initially methods for determining rates of photosynthesis, respiration and transpiration are considered. Plants are exposed to various levels of gaseous hydrogen chloride, and visible damage symptoms are correlated with quantitative changes in the rates of photosynthesis and respiration. Exposure effects on plant productivity are considered, and species resistance and susceptibility to hydrogen chloride damage are identified. Physiological and morphological mechanisms of resistance are elucidated.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0023, HUMAN PHYSICAL CAPABILITIES FOR AF JOBS

J.W. MCDANIEL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320950)

To improve the data base for describing the mobility, strength, and endurance variability of AF men and women where existing data are inadequate for the design, operation, and maintenance of AF systems. To improve systems effectiveness by developing designs for controls comparable with the operator's capabilities. To assess the adequacy of female strength and endurance characteristics for assignment to the role of aircrew members. To improve the design and placement of aircraft controls to minimize performance degradation from acceleration.

Methods are being employed to measure static strength and body mobility characteristics (FY 77-78). New methods for measuring dynamic strength and endurance are being investigated in FY 78-80. Equipment and procedures are being developed to measure and record the human operator configuration while performing aircrew-related tasks. To provide control design recommendations directly to procuring activities or through technical reports or design standards to improve the efficiency and operability of AF systems. Design complex controls based on the biomechanical characteristics of the hand to reduce the incompatibility between the precise operation of a control and its secondary control. Activation of controls in conventional and high-acceleration cockpits is being investigated. The effects of encumbering and restrictive equipment and clothing on operator performance is being investigated. A methodology will be developed in FY 77 for use by AFFTC to evaluate flight control resistance characteristics of new systems.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0024, PERFORMANCE LIMITS OF EAR INSERT COMMUNICATIONS

R.L. MCKINLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321350)

Air and ground crew voice communications are degraded by high-level environments that exceed the performance limits of present standard communication equipment creating command and control problems and safety hazards in routine as well as emergency situations. The objective of this effort is to establish the communication and protection performance limits in high-intensity noise environments of the ear insert communications concept. This effort will benefit ASD life support SPO and ground crew effectiveness and safety by identifying noise exposure envelopes within which the ear insert communications concept will provide adequate hearing protection and satisfactory voice communication.

The approach incorporates the laboratory simulation of specific aircraft noise environs, the progressive evaluation of ear insert units at increasingly intense levels of these environs by measurement of hearing protection characteristics and then communication effectiveness. a hearing protection/voice communication envelope of the performance limits will be developed based on these data for both monaural and binaural configurations of the ear insert receiver and compared to the performance of current standard items.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0025, MANUAL CONTROLLER DESIGN AND EVALUATION

D. MONK, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321050)

The purpose of this effort is to evaluate conventional and developmental manual controller designs and to obtain engineering data necessary for the most effective operational application of candidate controllers considered for subsystem control. Special attention will be given to the biomechanical aspects of hand controllers and the placement and style of secondary controls located on the hand grip. The research results will serve as a design guide for the selection of joystick type to match mission requirements, including quantification of the potential interference with the primary control task by secondary control activation. This work unit supports AFSC development goal TC-2.

Laboratory experimentation will be performed to determine and evaluate various performance characteristics of both operational and prototype controllers. Performance tests will be designed for each type of controller in accordance with mission profile and objectives. The performance of a series of candidate hand controllers will be investigated in a two-fold study. Results of various dynamic tracking tasks will be used to quantify tracking performance for individual controllers in terms of frequency response and ensemble statistical measures. The biomechanical aspects of hand controllers will be evaluated by measuring the interaction between secondary control operations and stability of a primary tracking task. The findings of these experiments will establish guidelines for joystick configuration with recommendations for the most effective application of the various designs.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0026, OPTICAL PROPERTIES OF WINDSCREENS

R.C. SEID, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321110)

To develop new measurement techniques for evaluating cockpit windscreen optical characteristics. To measure and quantify the optical characteristics exhibited by experimental and actual a/c windscreens, using both existing and new optical measures. To analyze the optic performance of the design windscreens for the F-111 and B-1 a/c, using computer ray-tracing techniques, assist in relating the optical characteristics of these, and similar, transparencies to specific functional effects on the human visual system (WU 71841803). The ultimate product of this work unit will be to recommend a specific set of optical measures that will be used in acceptance testing of a/c windscreens. This effort supports AFSC development goal MS-4.

Historically, a number of optical tests have been devised in an effort to quantify the optical characteristics of windscreens. None of these measures has proven to be infallible. In the previous work unit (71841204) several new measures of windscreen optical quality were being explored. These included multiple imaging, optical fourier analysis, angular deviation, binocular disparity and birefringence coloration. By comparing optical measures made on the windscreens with pilot acceptance and/or visual performance (see WU 71841803) it will be possible to determine which of these optical tests correlates with vision. Predistorted panels have been fabricated to be used in relating optical measures to vision. Windscreens and new panels have different characteristics and geometries will be used during the course of this work. The Windscreen Measurement Lab and the Image Metrics Facility will be used in accomplishing this work. Disciplines involved are optics, physics, and experimental psychology. Field data from F-111 windscreens will be obtained and compared with the optical measures developed for the previous work unit. Computer ray trace of the F-111 and B-1 windscreens will be accomplished for determining design-inherent angular deviation, binocular disparity and multiple imaging. This will be compared with actual measures to determine how much of the problem is due to manufacturing and how much is inherent in the design.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0027, EFFECTS OF LONG-DURATION NOISE EXPOSURE ON HUMAN AUDITORY PROCESSES

M.R. STEPHENSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321290)

Noise exposure standards for durations of 16 hours and greater as experienced during long missions and duty assignments are tentative and require additional knowledge to finalize criteria. Research carried out under this work unit shall attempt to identify and measure changes in human auditory processes effected by noise exposure durations of greater than 16 hours. These efforts will provide part of data base necessary to validate and/or revise existing tentative hearing damage risk criteria and establish firm criteria and standards. This work is being coordinated with the Environmental Protection Agency, and is being partially funded by EPA under Interagency Agreement Number EPA-IAG-D6-0356.

The approach will be to measure safe temporary hearing losses induced in human subjects by long-duration, low-level acoustic exposures and to analyze the hearing recovery curves as additional indicators of risk. Human subjects will be exposed to broadband noise with exposure durations of between 24 and 48 hours. Groups of subjects will experience systematic variations of such acoustic parameters as the intensity, duration, and duty cycle of the test stimulus. Effects of the stimuli will be identified by monitoring the subjects' audiometric thresholds at specific time intervals.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0028, DEVELOPMENT OF A STABLE LOW-ELECTROOSMOTIC-MOBILITY COATING FOR USE IN ELECTROPHORESIS SYSTEMS

J.W. VANDERHOFF, Lehigh University, School of Arts & Sciences, *Bethlehem, Pennsylvania* 18015 (NAS 8-32406)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0029, MULTIPLE-RISK FUNCTIONS FOR AIR FORCE PERSONNEL

R.A. ALBANESE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321780)

Coronary artery disease (CAD) is a major cause of ineffective time and disability retirement in the Air Force, and has been implicated in aircraft accidents. Thus early diagnosis and prevention of CAD in aircrew members is of importance to the Air

Force. Several clinical factors (serum cholesterol levels, blood pressure, EKG changes etc.) are known to be associated with an increased risk of CAD in human subjects. This work unit focuses on the development of mathematical equations which numerically relate clinical risk factors to the occurrence of CAD in flying personnel such that these equations can actually be used in early disease diagnosis and prevention at significant costs savings to the Air Force.

The first step will be a computer implementation of the Walker-Duncan algorithm for fitting the multiple logistic risk function. This function, when properly fitted to Air Force data, will numerically indicate the presence of CAD and/or the potential to develop CAD in flying personnel as a function of available clinical risk factors. The Walker-Duncan algorithm must then be compared with discriminant analysis techniques for fitting the multiple logistic risk function. The clinical factors entering the risk function as predictors of disease will be freed of confounding side-conditions, including seasonal effects, and daily rhythms, using multivariate statistical techniques. To refine the diagnosis of CAD, statistical analyses of x-ray views of the heart vessels (coronary cineangiograms) will be accomplished to improve the delineation of disease severity. This work was formerly a part of Project 6319 and was documented under work unit 02-10.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine BR, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0030, POSITIVE PRESSURE BREATHING SYSTEMS TO INCREASE G TOLERANCE

R.R. BURTON, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322280)

To evaluate the efficacy of positive pressure breathing both with and without thoracic counter pressure garments as a method for improving acceleration tolerance, and secondly to establish optimum schedules and methods of application of positive pressure breathing in terms of acceleration level and breathing pressure.

The approach will be to establish the efficacy and feasibility of using positive pressure breathing to increase acceleration tolerance by testing pre-g onset of constant level positive pressure breathing both with and without counter pressure garments and anti-g suits against currently employed methods of acceleration protection. The evaluations will be conducted on the USAFSAM human centrifuge using two acceleration profiles, the first will test the subjects' relaxed tolerances and the second will utilize straining techniques and evaluate fatigue tolerances in a rapidly changing acceleration environment (WU 7930-12-07). If the use of pre-g positive pressure breathing proves effective, a second phase of experimentation will be initiated to determine optimum g levels for the onset of partial pressure breathing and breathing pressures per g level. This information will be used to develop criteria for a positive pressure breathing regulator (WU 7930-11-XX) and the integration of positive pressure breathing with high oxygen concentration in the inspired gases as a method to reduce atelectasis which occurs during high g exposure (WU 7930-11-20).

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0031, CHEMICAL CHARACTERIZATION OF POLYCYCLIC ORGANIC MATERIALS IN AIR BASE ENVIRONMENTS

C.G. GIANNETTA, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320200)

Develop methodology for sampling and analysis of polycyclic organic materials (POM) that would assist AF labs such as the Environmental Health Lab in assessing the health impact of POM in air base environments.

A review of previous work will provide background for evolution of a unified scheme for sampling and analysis of POM. The concern will be for particulate POM (PPOM), Vapor phase POM (VPOM) and for POM in aqueous environments. Some areas to be explored include: (1) PPOM sampling on glass fiber filters, (2) VPOM sampling on porous polymer beads in solvents and in cryogenic traps, (3) extraction of POM from filters by ultrasonic solvent extraction, (4) gross separations by compound class (aromatics, paraffinics, oxygenates, etc.) and use of this kind of separation to give low-cost sampling index to POM contamination, (5) final separation and identification by gas chromatography (GC), high-pressure liquid chromatography (HPLC), GS mass spectroscopy (GCMS) and fluorescence spectroscopy and (6) field evaluation of lab-demonstrated techniques.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0032, THERMAL CHARACTERIZATION OF INFLIGHT AND GROUND COCKPIT ENVIRONMENTS

R.F. STRIBLEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322600)

Air Force operations expose personnel to a wide variety of thermally stressful conditions both in flight and on the ground. Measurements of these conditions will be performed under work unit 7930-13-11. This data base will be used by this work unit in the development of improved environmental control system specifications, flight simulator thermal conditions and procedure and practices during thermal chamber simulation of flight. Previous accomplishments in this area are documented under work unit 7164-17-23. This work unit is being established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

The data base established by work unit 7930-13-11 will permit calculation of human stress indices and provide a basis for rewriting MIL-E-38453A, as requested by the ASD Power and Propulsion Directorate. The new specification will allow trade-off studies by engineers in designing new systems. In addition, specifications will be developed for the performance of liquid conditioning garments, flight simulators and thermal chamber experiments.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0033, BIOENVIRONMENTAL ASSESSMENT OF HYDROGEN CHLORIDE IN SOLID ROCKET MOTOR

S.M. THOMAS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320840)

Large solid-propellant rocket motors release quantities of hydrogen chloride (HCl) as a product of combustion. Since HCl is a potential environmental hazard, measurement of its concentration in the established ground cloud becomes important to validate diffusion estimates governing launch constraints, as well as to assess the biological impact of chemical reactions which may occur between gas, aerosol and solid in the exhaust plume. The objective of this effort is to develop criteria and analytical techniques for monitoring of exhaust HCl as gas, aerosol and total chloride. The work supports operational requirements from SAMSO and SAMTEC as well as NASA and AFRPL. This effort is a continuation of JON 71641606 and will implement the new technical planning objective directed by HG Aerospace Medical Division.

A threefold analytical approach has been implemented to provide detection methodology for the various forms of HCl, infrared correlation spectrophotometry for gaseous HCl, chemiluminescence analysis for HCl in gaseous and aerosol forms, and microcoulometry for total chloride. Following laboratory and field testing of chemiluminescence analysis and microcoulometry, recommendations were made to SAMTEC on their applicability for both ground and airborne monitoring instrumentation. A second approach to determining HCl behavior within the exhaust cloud has been initiated. Laser Raman spectroscopy will provide a better description of the cloud's environment, such as the partitioning of the various forms of HCl.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0034, 2450 MHZ MICROWAVE ABSORPTION IN LARGE AND SMALL ANIMALS AND ITS BIOBEHAVIORAL EFFECTS ON BIRDS AND REPTILES
O.M. GHANDI, Utah Higher Education System, Graduate School, *Salt Lake City, Utah* 84112 (NAS 2-9555)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

6.0035, MAMMALIAN BODY SIZE, COMPOSITION AND GROWTH AS INFLUENCED BY HYPOKINESIA
G.C. PITTS, Univ. of Virginia, School of Medicine, *Charlottesville, Virginia* 22901 (NSG 2225)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MATRIX METHODS FOR SPECIAL FUNCTIONS ARISING IN APPLICATIONS
Y. IKEBE, Northwestern University, Graduate School, *Evanston, Illinois* 60201 (DF046590; AF-AFOSR-3183-77)

AF function - design of structures for aerospace vehicles. Opportunity - the use of matrix-theoretic techniques for the numerical computation of certain quantities associated with vibration and stability problems have not been exploited. Objective - this research intends to convert problems of computation of zeros of functions and eigenvalues of equations into problems in matrix theory which are solvable using readily available computer subroutines. How work contributes - the computation of zeros of functions will become more efficient and reliable.

Algorithms for computing the characteristic values of Mathieu's equation, the zeros of the regular coulomb wave function and their derivatives will be constructed. A detailed investigation of the nature of the complex zeros of the Bessel functions will be made. An investigation of computational methods for the eigenvalue problems associated with the spheroidal wave equation and lame equation will be pursued. Emphasis will be placed on the computational aspects of this analysis.

ADDENDA: Supporting agency address is: Af Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

7.0002, THE STABILITY AND DYNAMICS OF ELASTIC STRUCTURES AND WAVE PROPAGATION
E.L. REISS, New York University, School of Arts & Sciences, *New York, New York* 10012 (DF044940; AF-AFOSR-3076-76)

AF function - aerospace structures must respond stably under design loads. Opportunity - a new mathematical approach to buckling in the presence of imperfections and to secondary buckling. Objective - a safer, lighter, more efficient structure. How work contributes -original techniques for predicting catastrophic and secondary buckling and flutter.

Asymptotic techniques of stretching and matching yield nonsingular equations which extend bifurcation theory. This extended theory will be explored in the contexts of buckling with imperfections, secondary buckling, and nonlinear dynamic stability. Possible directions of research include extension of the theory to the more imperfection sensitive bifurcation points of higher multiplicity, periodic and quasi-periodic fluid structure interaction such as aircraft panel flutter, a statistical theory of bifurcation permitting direct determination of statistics, forced oscillation of nonlinear systems, and laminar flow transition to turbulence or chaos. Work on wave propagation in thin elastic structures, and nonlinear wave motion in air will be explored also by asymptotic techniques.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, A LABORATORY STUDY OF SILICATE CONDENSATION
K.L. DAY, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST76-21385)

There have been numerous calculations as to the nature of high-temperature interstellar and circumstellar condensates, but there has been very little relevant laboratory work. The limited laboratory work which is available does not include many measurements of infrared spectra which would be most useful for comparison with astronomical observations.

Silicate glasses and crystallites will be condensed from the vapor state using the technique of reactive sputtering. Structurally and chemically these glasses may be very similar to primordial circumstellar condensates. The condensed material will be carefully studied physically, chemically, and optically. In particular, emphasis will be focused on the infrared region from 3-300 microns which is of great interest to astronomers.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, ULTRAVIOLET STUDIES OF GALAXIES
D.W. WEEDMAN, Vanderbilt University, School of Arts & Sciences, *Nashville, Tennessee* 37232 (NSG 7343)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

10.0003, ATOMIC LINE STRENGTHS AND STARK BROADENING FOR SELECTED COMPOUNDS
R.D. BENGTSON, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 7347)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

GENERAL

11.0001, APPLICATIONS OF HEAT CAPACITY MAPPING MISSION SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS
D. MOORE, South Dakota State University, Remote Sensing Institute, *Brookings, South Dakota* 57006 (NAS 5-24206)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

11.0002, RESEARCH IN THE AREA OF PHYSICAL SCIENCES
H. ACETO, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (NAS 1-14972)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Organization & Management Office, Office of University Affairs

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VOLUME 15 NUMBER 22/ NOVEMBER 23, 1977

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-31070* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 84
Jun. 1977 114 p refs
(NASA-SP-7037(84)) Avail: NTIS E02 CSCL 01A

This bibliography list 347 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1977. Author

N77-31071* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 85
Jul. 1977 124 p refs
(NASA-SP-7037(85)) Avail: NTIS E02 CSCL 01A

This bibliography list 397 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1977. Author

N77-31072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF THE RESULTS OF DYNAMIC WIND-TUNNEL TESTS WITH THEORETICAL PREDICTIONS FOR AN AEROMECHANICAL GUST-ALLEVIATION SYSTEM FOR LIGHT AIRPLANES
Eric C. Stewart and L. Tracy Redd Washington Sep. 1977 47 p refs
(NASA-TN-D-8521; L-11352) Avail: NTIS HC A03/MF A01 CSCL 01A

Dynamic wind tunnel tests have been conducted on a 1/6-scale model of a general aviation airplane equipped with an all-mechanical gust alleviation system which uses auxiliary aerodynamic surfaces to drive the flaps. The longitudinal short period motions were studied under simulated gust conditions in order to verify the mathematical model used in a previous study to predict the performance of the full scale system and determine the amount of normal acceleration alleviation which could be attained. The model responses were measured for different configurations with the system active and without the system active for comparison. The tests confirmed the general relationships between the experimental variables and the model responses predicted by the mathematical model, but there were significant differences in the magnitudes of the responses. The experimental results for the model were used to estimate a reduction of 30 percent in the rms normal acceleration response of a similar full scale airplane in atmospheric turbulence. Author

N77-31073# Advisory Group for Aerospace Research and Development, Paris (France).
UNSTEADY AIRLOADS IN SEPARATED AND TRANSONIC FLOW
Apr. 1977 273 p In ENGLISH partly in FRENCH Presented at the 44th Meeting of the AGARD Struct. and Mater. Panel, Lisbon, 19-20 Apr. 1977
(AGARD-CP-226; ISBN-91-835-0197-7) Avail: NTIS HC A12/MF A01

The prediction and description of the separated flow environment and the essential effects of airframe response on individual aircraft components is reviewed along with flutter, aeroelastic instabilities, and other static and dynamic aeroelastic problems. Analytical approaches, wind tunnel tests as well as flight test techniques are included. For individual titles, see N77-31074 through N77-31091.

N77-31074# Hawker Siddeley Aviation Ltd., Kingston upon Thames (England).
UNSTEADY AIRLOADS IN SEPARATED AND TRANSONIC FLOW c02
C. L. Bore *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 9 p (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

The papers dealing with unsteady loads arising from separated flow that were presented at the AGARD Fluid Dynamics Panel's symposium on Prediction of Aerodynamic loading are reviewed. The principal topics discussed include dynamic phenomena arising from aircraft maneuvers transient dynamic stall loads, and methods for predicting buffet. Author

N77-31075*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEPARATED-FLOW UNSTEADY PRESSURES AND FORCES ON ELASTICALLY RESPONDING STRUCTURES c05
C. F. Coke, D. W. Riddle, and C. Hwang (Northrop Corp., Hawthorne, Calif.) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 25 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

Broadband rms, spectral density, and spatial correlation information that characterizes the fluctuating pressures and forces that cause aircraft buffet is presented. The main theme is to show the effects of elasticity. In order to do so, data are presented that were obtained in regions of separated flow on wings of wind-tunnel models of varying stiffness and on the wing of a full-scale aircraft. Reynolds number effects on the pressure fluctuations are also discussed. Author

N77-31076# General Dynamics/Fort Worth, Tex.
PREDICTION OF TRANSONIC AIRCRAFT BUFFET RESPONSE c08
Atlee M. Cunningham, Jr. and David B. Benepe, Sr. *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 21 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

A method for predicting aircraft buffet response is briefly reviewed. Rigid wind tunnel model fluctuating pressure data are used to form buffet forcing functions to which airplane responses are calculated with a mathematical dynamic model of the airplane. Buffet pressure data on the wing are used to estimate fluctuating loads on the horizontal tail. By including the extremes of

phasing and contributions of symmetric and antisymmetric airplane responses, predicted upper and lower bounds are established. The method is applied to a variable sweep fighter aircraft and predicted results are compared with flight test data. The types of buffeting flow considered for various wing sweep angles include separated and vortex flows as well as oscillating shocks. The current method is compared with three other methods in the correlation with flight test data. The inherent scatter of flight data is discussed as well as probable sources of the scatter. A mechanism is described by which wing torsional motion and shock oscillation couple to produce relatively severe buffeting conditions at a forward wing sweep. The importance of considering buffet fatigue damage on secondary structure is discussed.
Author

N77-31077# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE DYNAMIC RESPONSE OF WINGS IN TORSION AT HIGH SUBSONIC SPEEDS **c05**
G. F. Moss and D. Pierce *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 21 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

The structural response of aircraft wings to aerodynamic excitation at conditions appropriate to maneuvers at high subsonic speeds is discussed. Reference is made to wind tunnel experiments using models specially designed to deform under test in a realistic way as well as 'rigid' models of conventional construction. The primary torsion mode of vibration of the wings tended to be strongly excited under some aerodynamic flow conditions on the flexible models used, and in some cases the amplitude was large and similar to single-degree-of-freedom flutter in character. Data from some flight tests is quoted to demonstrate that this type of response may well occur in practice. Author

N77-31078# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).
EVALUATION OF VIBRATION LEVELS AT THE PILOT SEAT CAUSED BY WING FLOW SEPARATION **c39**
J. Becker and K. Dau (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 28 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

Examples of the evaluation of vibration levels on the pilot seat are presented. The first deals with the results of low speed measurements on a strake wing model with and without flap and slats, including the effect of leading edge blowing, in the incidence region 0 less than or equal to alpha less than or equal to 90 deg. The second example demonstrates the results obtained by the method based on measurements of fluctuating pressures on rigid models for two configurations with 25 and 45 degree wing sweep in the high subsonic region (0.7 less than or equal to M less than or equal to 0.85). Author

N77-31079# Royal Aircraft Establishment, Bedford (England).
MEASUREMENTS OF BUFFETING ON TWO 65 DEG DELTA WINGS OF DIFFERENT MATERIALS **c08**
D. C. Mabey and G. F. Butler *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 14 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

Measurements of buffeting were made on two 65 deg delta wings, one made of steel and the other of magnesium. A nondimensional buffet excitation parameter was derived from measured values of the rms buffeting response and total damping ratio. The materials were selected so that the resonant frequencies of the wings were almost the same, while giving a significant variation of response and damping ration under identical free stream conditions. The wings were tested at Mach numbers of 0.35, 0.7 and 1.4 and the Reynolds number was varied over a wide range. The results showed that the buffet excitation parameter for the first bending model was virtually identical for both wings and was independent of Reynolds number, except at very low Reynolds numbers. A significant level of aerodynamic damping was measured on the magnesium wing, and the experimental values agreed well with estimates made using slender wing theory. Author

N77-31080# British Aircraft Corp., Preston (England). Military Aircraft Div.
DYNAMIC LOADING OF AIRFRAME COMPONENTS **c39**
C. G. Lodge and M. Ramsey *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 26 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

The design of modern combat aircraft is discussed in terms of structural fatigue life. Unsteady loads due to separated flow conditions in maneuvering flight are examined. Dynamic loads on a modern variable sweep wing combat aircraft are predicted making use of wing tunnel model tests and results from flight tests. The predictions are compared with available prototype flight measurements. Author

N77-31081# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
AIRFRAME RESPONSE TO SEPARATED FLOW ON THE SHORT HAUL AIRCRAFT VFW 614 **c02**
Helmut Zimmermann and Guenter Krenz *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 9 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

Using the VFW 614 aircraft as an example the influence of an intermittent jet flow on sub-structures outside known jet boundaries is illustrated. Effects comparable to those due to the engine jet are caused also by the wake of movable wing parts such as spoilers and airbrakes. The VFW 614 is used again as an example to illustrate the occurrence of horizontal tail buffet due to flow disturbances for outside the spoiler wake region, and to describe the steps taken to eliminate this type of buffet. Several examples of flow separation with ensuing buffeting which typically occur in the course of flight trials, and measures to combat these disturbances are discussed. Author

N77-31082# Aeritalia S. p. A., Torino (Italy).
TAIL RESPONSE TO PROPELLER FLOW ON A TRANSPORT AIRPLANE **c02**
L. Chesta *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

The results of a flight investigation on tail vibrations on transport aircraft and the measures taken to overcome the subsequent problems are described. Factors studied include: (1) the source of vibrations; (2) the flight conditions in which they occur; and (3) the impact of the vibration level on the fatigue life. It is concluded that the three propeller blades and the associated airscrews are the excitation source of the vibrations.
Author

N77-31083# Saab-Scania, Linkoping (Sweden). Aerospace Div.
FLUTTER CALCULATION FOR THE VIGGEN AIRCRAFT WITH ALLOWANCE FOR LEADING EDGE VORTEX EFFECT **c08**
In AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 7 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

An application in a flutter calculation for the Viggen aircraft of a program system for aeroelastic calculations is briefly described. The result which is checked against an indepedent calculation shows that a large flutter margin exists. For increasing angle of incidence, however, the margin may decrease due to the effect of the leading edge vortices. An estimate of the decrease was obtained by applying a correction factor based on measured pressure distributions for steady flow to the calculated lift distribution. Author

N77-31084# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Dynamics Lab.
A BRIEF OVERVIEW OF TRANSONIC FLUTTER PROBLEMS **c08**
Walter J. Mykytow *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

A framework of industrial flutter problems with particular emphasis on the impact for the speed region is provided. Flutter stability boundaries are given re-emphasizing the critical design conditions present in the transonic flight region. The re-emphasis is accomplished using results from research flutter model tests, aircraft design, and development model tests, and aircraft flight damping measurements. B.B.

N77-31085# National Aerospace Lab., Amsterdam (Netherlands).
UNSTEADY AIRLOADS ON AN OSCILLATING SUPERCRITICAL AIRFOIL c02
N. Tijdeman, P. Schippers, and A. J. Pearsoon *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 15 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

Results are presented of unsteady pressure measurements on a two-dimensional model of the supercritical NLR 7301 airfoil performing pitching oscillations about an axis at 40 per cent of the chord. Author

N77-31086# General Dynamics/Convair, San Diego, Calif.
THE TRANSONIC OSCILLATING FLAP: A COMPARISON OF CALCULATIONS WITH EXPERIMENTS c02
R. Magnus and H. Yoshihara (Boeing Co., Seattle) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 5 p refs Sponsored by AF (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

Finite difference calculations based on the exact inviscid equations for an oscillating flap on an airfoil at M = 0.875 are compared to the Tijdeman-Schippers experimental results. Viscous effects were incorporated in a phenomenological manner using viscous displacement ramps. Reasonably good agreement was obtained, but with a significant discrepancy in the shock motions attributable to a mismatch in the surface pressures upstream of the shock. Recalculation at M = 0.854 yielded results in good overall agreement with the experiments at M = 0.875 for both the steady and the unsteady cases. Author

N77-31087*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFICIENT SOLUTION OF UNSTEADY TRANSONIC FLOWS ABOUT AIRFOILS c02
W. F. Ballhaus and P. M. Goorjian (Informatics Corp., Palo Alto, Calif.) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 11 p refs Prepared in cooperation with AAMRDL (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01 CSCL 01A

An implicit finite difference procedure was developed for the efficient solution of unsteady transonic flow fields. Sample computations illustrate applications of procedures to aerodynamic problems. Solutions are presented that illustrate three types of shock wave motion that can result from airfoil control surface oscillations. The significant effect of wind tunnel wall conditions on these shock wave motions is demonstrated. Solutions are also presented for a simple aeroelastic problem in which the flow field equations and the structural motion equations are integrated simultaneously in time. Both stable and unstable aeroelastic interactions are considered. The procedure is adapted to compute unsteady aerodynamic force coefficients by the indicial method. Author

N77-31088# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL CALCULATION OF UNSTEADY TRANSONIC FLOWS c02
Alain Lerat and Jacques Sides *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 10 p refs In ENGLISH and FRENCH (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

A finite difference method is presented for the calculation of inviscid transonic flow over an airfoil in arbitrary rigid body motion. The two dimensional unsteady Euler equations in conservation law form are solved in a transformed plane defined through a time dependent mapping. The numerical scheme makes use of several variants of MacCormack scheme in the space domain with suitable matchings. A mesh refinement is used in the vicinity of shock waves. The slip condition is satisfied on the exact airfoil surface and the boundary condition at downstream infinity takes into account the nonhomentropy of the flow. Calculations are made of the unsteady flow over the airfoil oscillating in pitch at Mach 0.8. Author

N77-31089# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A PRACTICAL FRAMEWORK FOR THE EVALUATION OF OSCILLATORY AERODYNAMIC LOADING ON WINGS IN SUPERCRITICAL FLOW c02
H. C. Garner *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 15 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

An approximate theoretical treatment is devised in terms of nonlinear steady surface pressure and linear oscillatory loading. The steady data are taken either from transonic small perturbation theory or from static measurements of surface pressure. The resulting theoretical or semi-empirical method can take account of stream Mach number, mean incidence, mode of oscillation, frequency and amplitude. The calculations are organized into a computer program, the scope and broad details of which are outlined. Its first application is in support of a wind tunnel study of a rigid half wing with freedom to rotate about a swept axis. The experiment provides measurements of steady and oscillatory pressure distributions over the range of Mach number from 0.60 to 0.86. The oscillatory results are compared with calculations from linearized theory and from the present method in its theoretical and semi-empirical forms. Like the dynamic experiments, the calculations show large differences between oscillatory chordwise load distributions under subcritical and supercritical conditions. In particular, the region surrounding a shockwave exhibits large and rapid changes in both amplitude and phase of the measured loading, which are reproduced qualitatively in the calculations. The resulting generalized aerodynamic forces are found to depend significantly on the development of supercritical flow. The method should provide an economical indication of the influence of mean flow on the flutter aerodynamics in the lower transonic regime. Author

N77-31090*# Boeing Commercial Airplane Co., Seattle, Wash. Flutter Research Group.
APPLICATION OF A FINITE DIFFERENCE METHOD TO THE ANALYSIS OF TRANSONIC FLOW OVER OSCILLATING AIRFOILS AND WINGS c02
Warren H. Weatherill, James D. Sebastian (Boeing Computer Services, Inc., Seattle), and F. Edwards Ehlers *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p refs (For primary document see N77-31073 22-01)
(Contract NAS1-14204)
Avail: NTIS HC A12/MF A01 CSCL 01A

A finite difference method for solving the unsteady flow about harmonically oscillating wings is investigated. The procedure is based on separating the velocity potential into steady and unsteady parts and linearing the resulting unsteady differential equation for small disturbances. Solutions are obtained using relaxation procedures. The means for improving the solution stability characteristics of the relaxation process are explored. A direct procedure is formulated which permits obtaining solutions for combinations of Mach number and reduced frequency for which the relaxation process has proved unstable. The pressure distribution for an aspect ratio 5 rectangular wing oscillating in pitch is presented. Author

N77-31091# Flow Research, Inc., Kent, Wash.
NUMERICAL SOLUTION OF THE UNSTEADY TRANSONIC SMALL-DISTURBANCE EQUATIONS c02
M. M. Hafez, M. H. Rizk, and E. M. Murman *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p refs (For primary document see N77-31073 22-01)
(Contract F33615-76-C-3067)
Avail: NTIS HC A12/MF A01

Problems that occur in the small unsteady harmonic perturbation approach of calculating transonic flutter problems are examined. Numerical instability that occurs in the relaxation procedure for solving the reduced potential equation is studied, the instability results in a critical reduced frequency (for a given

Mach number) beyond which relaxation solutions are divergent. A numerical treatment of Helmholtz's equation by iterative techniques studied and a one dimensional model is computed to demonstrate a suggested solution. The second problem is to properly treat the movement of a shock wave caused by the harmonic perturbation of the body. The shock movement is described by a special equation, which is derived from a consistent perturbation expansion for the nonlinear differential equation and from shock jump relations. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-31092 Polish Academy of Sciences, Warsaw.
CALCULATING FLOW-ROUND OF A STRAIGHT-LINE GRID [OBLICZANIE OPLYWU PALISADY PROSTOLINIOWEJ]
E. Klonowska, W. J. Prosnak, and J. K. Szymanski 20 Nov. 1976 108 p refs In POLISH
Avail: Issuing Activity

An algorithm for determining the flow-round of a straight-line grid is described using the method of conformal mapping and a set of programs in the ALGOL 1204 language. Individual stages of the algorithm are presented for determining the function which maps the canonic grid of regions on a given grid of arbitrary profiles, controlling the mapping function, and calculating the distribution of velocity and pressure on the perimeter of an arbitrary profile in the grid and its aerodynamic coefficients. Author

N77-31093*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND SUPERSONIC LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF AN AFT-TAIL FIGHTER CONFIGURATION WITH CAMBERED AND UNCAMBERED WINGS AND CAMBERED FUSELAGE
Samuel M. Dollyhigh Sep. 1977 79 p refs
(NASA-TN-D-8472; L-11424) Avail: NTIS HC A05/MF A01 CSCL 01A

The longitudinal aerodynamic characteristics of a fighter airplane concept has been determined through an investigation over a Mach number range from 0.50 to 2.16. The configuration incorporates a cambered fuselage with a single external compression horizontal ramp inlet, a clipped arrow wing, twin horizontal tails, and a single vertical tail. The wing camber surface was optimized in drag due to lift and was designed to be self trimming at Mach 1.40 and at a lift coefficient of 0.20. The fuselage was cambered to preserve the design wing loadings on the part of the theoretical wing enclosed by the fuselage. An uncambered of flat wing of the same planform and thickness ratio distribution was also tested. Author

N77-31094*# Vought Corp., Hampton, Va.
NONPLANAR WING LOAD-LINE AND SLENDER WING THEORY
John DeYoung Washington NASA Aug. 1977 78 p refs (Contract NAS1-13500)
(NASA-CR-2864) Avail: NTIS HC A05/MF A01 CSCL 01A

Nonplanar load line, slender wing, elliptic wing, and infinite aspect ratio limit loading theories are developed. These are quasi two dimensional theories but satisfy wing boundary conditions at all points along the nonplanar spanwise extent of the wing. These methods are applicable for generalized configurations such as the laterally nonplanar wing, multiple nonplanar wings, or wing with multiple winglets of arbitrary shape. Two dimensional theory infers simplicity which is practical when analyzing complicated configurations. The lateral spanwise distribution of angle of attack can be that due to winglet or control surface deflection, wing twist, or induced angles due to multiwings, multiwinglets, ground, walls, jet or fuselage. In quasi two dimensional theory the induced angles due to these extra conditions are likewise determined for two dimensional flow. Equations are developed for the normal to surface induced velocity due to a nonplanar trailing vorticity distribution. Application examples are made using these methods. Author

N77-31095*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTATION OF THE INVISCID SUPERSONIC FLOW ABOUT CONES AT LARGE ANGLES OF ATTACK BY A FLOATING DISCONTINUITY APPROACH
James Daywitt, Paul Kutler, and Dale Anderson (Iowa State Univ. of Sci. and Technol.) Aug. 1977 95 p refs
(NASA-TM-73259; A-7104) Avail: NTIS HC A05/MF A01 CSCL 01A

The technique of floating shock fitting is adapted to the computation of the inviscid flowfield about circular cones in a supersonic free stream at angles of attack that exceed the cone half-angle. The resulting equations are applicable over the complete range of free-stream Mach numbers, angles of attack and cone half-angles for which the bow shock is attached. A finite difference algorithm is used to obtain the solution by an unsteady relaxation approach. The bow shock, embedded cross-flow shock, and vortical singularity in the leeward symmetry plane are treated as floating discontinuities in a fixed computational mesh. Where possible, the flowfield is partitioned into windward, shoulder, and leeward regions with each region computed separately to achieve maximum computational efficiency. An alternative shock fitting technique which treats the bow shock as a computational boundary is developed and compared with the floating-fitting approach. Several surface boundary condition schemes are also analyzed. Author

N77-31096*# Boeing Co., Seattle, Wash. Military Airplane Development.
OPERATING CHARACTERISTICS OF AN INLET MODEL TESTED WITH A 0.5m POWERED FAN AT HIGH ANGLES OF ATTACK
J. L. Koncsek and R. J. Shaw Sep. 1977 60 p refs Prepared in cooperation with NASA; Lewis Res. Center
(Contract NAS3-20597)
(NASA-CR-135270; D180-20798-1) Avail: NTIS HC A04/MF A01 CSCL 01A

An inlet model designed for high angle of attack capability, coupled to a .508 m tip diameter turbofan simulator, was tested in the NASA-Lewis Research Center's 9-by 15-ft low speed wind tunnel. The test variables were: tunnel velocity, 0 to 75 m/s; inlet angle of attack, 0 to 120 deg; and fan face corrected airflow per unit area, 75 to 200 kg/s sqm. The inlet flow separation boundaries, the fan face total pressure recovery and distortion characteristics, and the fan blade vibratory stresses were determined. The recovery, distortion, and stress levels showed no abrupt changes at the onset of separation, but became gradually more unfavorable as the size and intensity of the separation increased as induced by increasingly severe operating conditions. Performance characteristics for a large scale model of the inlet were estimated from these test results. Author

N77-31097# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRESSURE MEASUREMENTS ON A SPINNING WIND TUNNEL MODEL BY MEANS OF TELEMETRY Final Report
Andrew Mark May 1977 31 p refs
(DA Proj. 1W6-62618-AH-80)
(AD-A040909; BRL-MR-2750) Avail: NTIS HC A03/MF A01 CSCL 20/4

The Magnus force is a side which exists on spin stabilized projectiles at angle of attack. Although its absolute magnitude is small, it has a destabilizing effect and as such is of interest to projectile designers. A large part of the Magnus force arises from an asymmetric pressure distribution caused by the distorted boundary layer. Experimentally, the Magnus effect has always been measured in terms of force by using strain gage balances. This paper discusses a possible technique for measuring the pressure distribution about a spinning body and obtaining the force by integration. It would also serve as a check for three dimensional boundary layer calculations presently available. GRA

N77-31098# Purdue Univ., Lafayette, Ind.
UNSTEADY TRANSONIC FLOWS WITH SHOCK WAVES IN

AN ASYMMETRIC CHANNEL

John S. K. Chan and T. C. Adamson, Jr. 11 May 1977 42 p refs Prepared by Mich. Univ., Ann Arbor
(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-038)
(AD-A040846; SQUID-MICH-17-PU) Avail: NTIS HC A03/MF A01 CSCL 20/4

Two-dimensional inviscid, unsteady transonic flows with shock waves in asymmetric channels with arbitrary wall shapes are investigated, using the method of matched asymptotic expansions. With the exception of thin regions in the neighborhood of the channel throat and the neighborhood of the shock wave, solutions found using linearized governing equations are valid. In the regions enclosing the shock wave, an inner solution which satisfies the shock jump conditions and matches with the outer solutions, is presented. The shock shape is found as part of the solution, which is obtained numerically using the method of integral relations. A composite solution, uniformly valid throughout the channel, and the relation between the instantaneous shock wave position and back pressure far downstream are presented.
Author (GRA)

N77-31099# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

THE FLOW ABOUT A SLENDER PROPELLER-DRIVEN BODY IN A TEMPERATURE STRATIFIED FLUID

T. F. Swean, Jr. and J. A. Schetz Mar. 1977 115 p refs
(Contract N00014-75-C-0763; ARPA Order 1910; NR Proj. 062-481)
(AD-A040847; VPI-Aero-062) Avail: NTIS HC A06/MF A01 CSCL 20/4

The turbulent wake produced by a stern propeller-driven body in a temperature stratified fluid is measured using thermocouples and pitot tubes of various size, a yawhead probe, a cross-wire hot wire, and a straight-wire hot wire. The velocity and thermal boundary layers on the body upstream of the propeller are also examined. Mean flow velocities, static pressure, flow angularity, and mean temperature distributions are reported at five downstream stations. The testing was conducted in a six ft by six ft subsonic wind tunnel. A significant increase in mixing rate is produced by the propeller in the region of 4.0 body diameters downstream. Temperature fluctuation is mild across the wake except in the vicinity of the propeller tips where it becomes relatively large. GRA

N77-31100# Naval Ship Research and Development Center, Bethesda, Md. Dept. of Aviation and Surface Effects.

HOVER EVALUATION OF CIRCULATION CONTROL HIGH SPEED ROTOR

Kenneth R. Reader Jun. 1977 42 p refs
(AD-A040921; AERO-1239; DTNSRDC-77-0034) Avail: NTIS HC A03/MF A01 CSCL 01/3

A high-speed rotor model, designated the RB-CCR (reverse blowing circulation control rotor), was evaluated in the hover mode. The model was tested as a two- and four-bladed rotor with several rotor configurations. In general the hover tests demonstrated that a good figure of merit can be obtained over a large range of collective pitch angles. A comparison of configurations at various collective angles showed a steady improvement in performance with increasing collective pitch angle. The RB-CCR model demonstrated that the high-speed rotor can hover with a zero mechanical collective pitch angle at a figure of merit of about 0.50. GRA

N77-31101# Naval Surface Weapons Center, White Oak, Md.

A PROGRAM FOR COMPUTING STEADY INVISCID THREE-DIMENSIONAL SUPERSONIC FLOW ON REENTRY VEHICLES. VOLUME 1: ANALYSIS AND PROGRAMMING

J. M. Solomon, M. Ciment, R. E. Ferguson, J. B. Bell, and A. B. Wardlaw, Jr. 11 Feb. 1977 232 p refs
(AD-A040833; NSWC/WOL/TR-77-28-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 16/3

A comprehensive computational procedure is presented for predicting the supersonic region of the flow field on advanced reentry vehicle shapes in steady flight at pitch and yaw. The procedure utilizes explicit second order accurate finite difference methods applied to the conservation law form of the steady inviscid flow equations. Improved numerical methods are used at the body surface and the bow shock wave. Provisions for treating body geometries with discontinuous slopes are also included. Either perfect gas or real gas equilibrium thermodynamic properties can be used. The computational procedure is implemented as a FORTRAN computer code which provides a practicable representation of the inviscid flow field and the resulting aerodynamic force and moment on the vehicle. In this report the analytical and numerical development of the procedure is presented and the associated computer code is described. A comparison report contains detailed instructions for operating the code and interpreting the output results. Author (GRA)

N77-31102# Emmanuel Coll., Boston, Mass.

REPORT ON ATMOSPHERIC ENVIRONMENT INTERACTION WITH FREE AND TETHERED BALLOONS Final Report, 15 Jan. 1974 - 14 Jan. 1977

Robert L. Vesprini and M. Patricia Hagan Hanscom AFB, Mass. AFGL Apr. 1977 86 p refs
(Contract F19628-74-C-0039)
(AD-A041911; AFGL-TR-77-0100) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report contains information in four areas: (1) Air-Launched Balloon System (ALBS); Programs, their Description, Flowcharts, and Documentations; (2) Balloon Tracking Using VOR; Description and Logic of Mathematical Development, and a Program Employing These Techniques (Including Flowchart and Documentation); (3) Tethered Balloon Experiment: Analysis and Recommendations; and (4) Balloon Flight Simulations Using Eglin AFB, Holloman, and White Sands Wind Data. GRA

N77-31103# Southampton Univ. (England). Theoretical Aerodynamics Unit.

THE NUMERICAL CALCULATION OF SUBCRITICAL STEADY POTENTIAL FLOW AROUND AN UNYAWED ELLIPSOID

P. W. Duck London Aeron. Res. Council. 1977 34 p refs Supersedes RAE-TR-75041; ARC-36235 Prepared jointly with RAE, Farnborough, Engl.
(ARC-R/M-3795; RAE-TR-75041; ARC-36235) Avail: NTIS HC A03/MF A01; HMSO £4; PHI

The problem of a subcritical, potential, steady, three-dimensional flow past an unyawed ellipsoid is considered, using ellipsoidal coordinates. The full equations of motion and the exact body surface boundary condition are used throughout. Further, by means of simple transformation the entire flow field is taken into the computation. A finite difference method, followed by an iterative process is used for the solution of the flow equations. Mach number distributions are given for a number of examples, for the free-stream flow aligned along either the major axis, or the second major axis of the ellipsoid. Author (ESA)

N77-31104# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

ITERATIVE CALCULATION OF FLOW PAST A THICK CAMBERED WING NEAR THE GROUND

C. C. L. Sells London Aeron. Res. Council 1977 26 p refs Supersedes RAE-TR-76053; ARC-36856
(ARC-CP-1370; RAE-TR-76053; ARC-36856) Avail: NTIS HC A03/MF A01; HMSO £1.75; PHI

The method to compute the steady low-speed inviscid flow past a wing in free air, is extended to take account of ground effect. The basic method represents the perturbation due to the wing by iteratively computed distributions of sources and doublets on the wing chordal surface; at each iteration the ground effect is represented by the images in the ground plane of these distributions, the strengths of which are calculated from the computed errors in the boundary conditions on upper and lower surfaces. For a given angle of incidence (and Mach number), several heights above the ground in succession can be treated, with some economy in computing time. Results are presented for a two-dimensional section (RAE 100) and for two variants of a wing of 'airbus' type. Comparisons with another method for the RAE section suggest that the present method generally needs at least three iterations, and that for very accurate results at low ground heights further work on the program is needed. Author (ESA)

N77-31105# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

ITERATIVE DESIGN TECHNIQUES FOR THICK CAMBERED WINGS IN SUBCRITICAL FLOW

C. C. L. Sells London Aeron. Res. Council 1977 61 p refs Supersedes RAE-TR-76027; ARC-36857
(ARC-CP-1371; RAE-TR-76027; ARC-36857) Avail: NTIS HC A04/MF A01; HMSO £3; PHI

The development of computer programs to design camber and twist distribution, and in some applications thickness distributions for a wing without dihedral in steady inviscid incompressible (or subcritical) flow is described. The method for computing steady, inviscid, subcritical flow past a thick cambered wing is extended to design applications. Four problems are considered: (1) given thickness and doublet (first-order loading) distributions; (2) given thickness and upper-surface pressure distributions; (3) given loading and upper-surface pressure distributions; (4) a hybrid of (2) and (3) in which the thickness is specified everywhere except near the root, and is determined near the root when the doublet distribution is constrained to exhibit spanwise invariance in that region. Convergence for the first problem is excellent. For all problems, good convergence is obtained outboard. For the single case reported of the second problem, convergence was secured near the root but cannot yet be guaranteed. Near the root, slow convergence was obtained for the third problem, rather better convergence for the fourth problem. This hybrid option is tentatively recommended.
Author (ESA)

N77-31106# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

A WIND-TUNNEL INVESTIGATION OF THE EFFECTS OF FLAP SPAN AND DEFLECTION ANGLE, WING PLANFORM AND A BODY ON THE HIGH-LIFT PERFORMANCE OF A 28 DEG SWEPT WING

D. A. Lovell London Aeron. Res. Council 1977 199 p refs Supersedes RAE-TR-76030; ARC-36936
(ARC-CP-1372; RAE-TR-76030; ARC-36936) Avail: NTIS HC A09/MF A01; HMSO £8; PHI

Lift, drag and pinching moment were measured over an extensive range of configurations of the high-lift system on a wing of basic aspect ratio 8.35 and with a trailing-edge planform extension and a body added. The results were analyzed and compared with two linear-theory prediction methods. The measured increments in lift generated by the various elements of the high-lift system were lower than the predicted levels. An exploratory analysis of the drag results showed that the lift-dependent drag factor was considerably underestimated by the linear theory, particularly when the slat was deployed. The limitations of the planar vortex sheet used in the theory and the neglect of viscous effects are suggested as the principal reasons for the difference between experiment and theory. Deflection of the flap produced a load, which acted at a distance forward of the mean quarter chord of the flap, that was practically independent of incidence and flap span. The wing/body interference effect was insensitive to flap span and there was some evidence of a download being generated on the rear body when the high-lift system was deployed. The performance of the high-lift system was downgraded when the wing planform was extended in the root region and this was attributed to the greater non-uniformity of the spanwise loading. Author (ESA)

N77-31107# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

REEFING OF PARACHUTES: DRAG AREA RATIOS VS REEFING RATIOS Final Report, 1975 - 1976

Theodore W. Knacke Jul. 1976 61 p refs
(AD-A036497; ASD-TR-76-2) Avail: NTIS HC A04/MF A01 CSCL 01/3

Reefing data were collected and evaluated for the following parachute types: solid circular parachutes of flat, conical, and triconical design; extended skirt parachutes of 10 percent flat extended, 10 percent straight extended, and fully extended (14.3 percent) design; and slotted parachutes of ringslot, Ringsail, and flat and conical ribbon design. Various reefing terminologies are discussed that have been used in the past, and a recommendation is made for a common terminology. Background data are provided for all parachutes analyzed. GRA

N77-31108# General Dynamics/Fort Worth, Tex.

ASD ADVANCED PROGRAM RESEARCH INLET DATA ANALYSIS REPORT FOR 1/5.2-SCALE MODEL INLET TESTS Final Report, 14 Jul. 1975 - 1 Sep. 1976

Charles C. Mann and Jack E. Garner Jan. 1977 90 p refs (Contract F33615-75-C-5289)
(AD-A040707; ASD-TR-76-35) Avail: NTIS HC A05/MF A01 CSCL 21/5

The analysis of wind-tunnel data from tests of a 1/5.2-scale inlet research model covered was conducted. Inlet design and engine/inlet compatibility criteria are based on the F101-GE-100 engine characteristics and requirements. Detailed inlet flow-field analyses are discussed. Inlet pressure recovery, distortion, and compatibility parameters are presented for a basic configuration from Mach 0.55 to Mach 2.0. Data for an alternate configuration are presented for Mach 0.55 to 1.5. A limited amount of data are also presented for other configurations that were tested.
Author (GRA)

N77-31109# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

WIND TUNNEL RESULTS OF A 10-PERCENT SCALE POWERED SCAT VTOL AIRCRAFT Interim Report, Jul. - Oct. 1976

David G. Lee and David W. Lacey Mar. 1977 31 p refs
(AD-A040313; DTNSRDC/ASED-371) Avail: NTIS HC A03/MF A01 CSCL 01/3

The low-speed aerodynamic characteristics of a 10-percent scale powered SCAT (Surveillance, Communications, ASMD Warning, and Targeting) configuration were investigated in the 8- by 10-foot subsonic north wind tunnel. Force and moment data were obtained for both powered and unpowered VTOL, fixed-wing aircraft. Analysis of the data indicate that the configuration is statically stable in both pitch and yaw and that control is adequate for both axes. The addition of a large aft-mounted radome did not significantly change longitudinal characteristics, but did increase lateral-directional stability. Two wings of different airfoil sections were evaluated: a NACA design and a Liebeck design. The Liebeck wing section increased lift over that generated by the NACA baseline wing section.
Author (GRA)

N77-31074# Hawker Siddeley Aviation Ltd., Kingston upon Thames (England).

UNSTEADY AIRLOADS IN SEPARATED AND TRANSONIC FLOW

C. L. Bore *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 9 p (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31081# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).

AIRFRAME RESPONSE TO SEPARATED FLOW ON THE SHORT HAUL AIRCRAFT VFW 614

Helmut Zimmermann and Guenter Krenz *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 9 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31082# Aeritalia S. p. A., Torino (Italy).

TAIL RESPONSE TO PROPELLER FLOW ON A TRANSPORT AIRPLANE

L. Chesta *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31085# National Aerospace Lab., Amsterdam (Netherlands).

UNSTEADY AIRLOADS ON AN OSCILLATING SUPERCRITICAL AIRFOIL

N. Tijdeman, P. Schippers, and A. J. Pearsoon *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 15 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31086# General Dynamics/Convair, San Diego, Calif.

THE TRANSONIC OSCILLATING FLAP: A COMPARISON

OF CALCULATIONS WITH EXPERIMENTS
R. Magnus and H. Yoshihara (Boeing Co., Seattle) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 5 p refs Sponsored by AF (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31087*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFICIENT SOLUTION OF UNSTEADY TRANSONIC FLOWS ABOUT AIRFOILS
W. F. Ballhaus and P. M. Goorjian (Informatics Corp., Palo Alto, Calif.) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 11 p refs Prepared in cooperation with AAMRDL (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01 CSCL 01A

N77-31088# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL CALCULATION OF UNSTEADY TRANSONIC FLOWS
Alain Lerat and Jacques Sides *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 10 p refs In ENGLISH and FRENCH (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31089# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A PRACTICAL FRAMEWORK FOR THE EVALUATION OF OSCILLATORY AERODYNAMIC LOADING ON WINGS IN SUPERCRITICAL FLOW
H. C. Garner *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 15 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31090*# Boeing Commercial Airplane Co., Seattle, Wash. Flutter Research Group.
APPLICATION OF A FINITE DIFFERENCE METHOD TO THE ANALYSIS OF TRANSONIC FLOW OVER OSCILLATING AIRFOILS AND WINGS
Warren H. Weatherill, James D. Sebastian (Boeing Computer Services, Inc., Seattle), and F. Edwards Ehlers *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p refs (For primary document see N77-31073 22-01)
(Contract NAS1-14204)
Avail: NTIS HC A12/MF A01 CSCL 01A

N77-31091# Flow Research, Inc., Kent, Wash.
NUMERICAL SOLUTION OF THE UNSTEADY TRANSONIC SMALL-DISTURBANCE EQUATIONS
M. M. Hafez, M. H. Rizk, and E. M. Murman *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p refs (For primary document see N77-31073 22-01)
(Contract F33615-76-C-3067)
Avail: NTIS HC A12/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N77-31110# Frost Engineering Development Corp., Englewood, Colo.
DESIGN AND EVALUATION METHODS FOR OPTIMIZING EJECTION SEAT CUSHIONS FOR COMFORT AND SAFETY Final Report, Jul. 1967 - Jun. 1968
Ernest L. Stech Feb. 1977 134 p refs
(Contract F33615-67-C-1912; AF Proj. 7231)
(AD-A036035; AMRL-TR-68-126; Rept-338-7) Avail: NTIS HC A07/MF A01 CSCL 01/3

Two kinds of cushions, passive and inflatable, were developed using analytic and empirical optimization procedures to enhance both comfort and safety. Comfort tests were run on a series of polyurethane foams, an inflatable seat cushion, and two operational seat cushions. Load-deflection and damping coefficient data were also obtained. Results of the tests showed that comfort increases as cushion thickness or inflation pressure increases. Analog computer results using a single-degree-of-freedom model of the human body demonstrated an increasing overshoot with increasing thickness or inflation pressure except for low density polyurethane foam. Optimization curves for comfort versus dynamic overshoot were generated and used in the design of the optimized cushions. GRA

N77-31111# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SAFETY (AVIATION MATERIAL) Final Report
9 Dec. 1976 52 p Supersedes Report no. MTP-7-3-5
(AD-A041021; TOP-7-3-506) Avail: NTIS HC A04/MF A01 CSCL 01/3

The document identifies existing test methodology and techniques necessary to determine the degree to which aviation materiel meets the safety requirements stated in the requirements documents. These procedures cover the requirements, aircraft armament, airframe, ejection seat, electronic, mechanical, and miscellaneous hazards relating to Army aircraft. A guide for laser safety is included for use when lasers are mounted in Army aircraft. Author (GRA)

N77-31112# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
US AIR CARRIER ACCIDENTS INVOLVING FIRE, 1965 THROUGH 1974 AND FACTORS AFFECTING THE STATISTICS
17 Feb. 1977 64 p refs
(PB-266883/8; NTSB-AAS-77-1) Avail: NTIS HC A04/MF A01 CSCL 01B

Statistical data on U.S. air carrier accidents involving fire from 1965 through 1974 are compared with similar data for the preceeding decade. While fire still occurs in about 20 percent of the accidents in scheduled passenger operations, the ratio of fatalities from all causes to exposed occupants declined 65 percent in this study period and the ratio of fatalities from the effects of fire and smoke to exposed occupants declined 37 percent. The almost exclusive use, in this study period, of turbojet-powered aircraft, their improved reliability, and the use of kerosene-type fuel are factors influencing the statistics. GRA

N77-31113# Taussig Associates, Canaan, N. H.
BRITISH AIRWAYS: AN ANALYSIS OF EFFICIENCY AND COST LEVELS Final Report
William M. Taussig May 1977 68 p
(Contract DOT-OST-PS-70292)
(PB-268060/1; OST-PS-70292) Avail: NTIS HC A04/MF A01 CSCL 01B

The cost and efficiency data publicly available for British Airways is summarized and used to develop comparisons with U.S. air carriers. GRA

N77-31114# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING AERIAL APPLICATION OPERATIONS, U.S. GENERAL AVIATION 1975 Accident Report
1975 292 p
(PB-267654/2; NTSB-AMM-77-11) Avail: NTIS HC A13/MF A01 CSCL 01B

Facts, conditions, circumstances, and probable causes are given for 429 general aviation aerial application accidents occuring in 1975. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s). GRA

N77-31115# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT, US GENERAL AVIATION, 1975
1975 74 p

(PB-267652/6; NTSB-AMM-77-9) Avail: NTIS HC A04/MF A01 CSCL 01B

Reports of U.S. general aviation accidents involving amateur/home built aircraft occurring in 1975 are presented. Included are 114 accident briefs, 23 of which involve fatal accidents. The facts, conditions, circumstances and probable cause(s) factor(s) for each accident are given. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s). GRA

N77-31116# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS, INVOLVING CORPORATE/EXECUTIVE AIRCRAFT, US GENERAL AVIATION, 1975

1975 55 p

(PB-267651/8; NTSB-AMM-77-8) Avail: NTIS HC A04/MF A01 CSCL 01B

General aviation corporate/executive aircraft accidents occurring in the U.S. in 1975 are reported. Included are 63 accident briefs, 17 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injuries and causal/factors(s). GRA

N77-31117# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS AND ACCIDENTS INVOLVING MISSING AND MISSING LATER RECOVERED AIRCRAFT, US GENERAL AVIATION, 1975

1975 111 p

(PB-267650/0; NTSB-AMM-77-7) Avail: NTIS HC A06/MF A01 CSCL 01B

One hundred twenty-nine general aviation missing and missing later recovered accidents occurring in the U.S. in 1975 are reported. Each brief presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N77-31118# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS INVOLVING ALCOHOL AS A CAUSE/FACTOR, US GENERAL AVIATION, 1975

11 Feb. 1977 44 p

(PB-267649/2; NTSB-AMM-77-6) Avail: NTIS HC A03/MF A01 CSCL 01B

A publication containing reports on all U.S. general aviation accidents, occurring in 1975, involving alcohol impairment as a cause/factor is reviewed. Included are 49 accident briefs, 42 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N77-31119# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF FATAL ACCIDENTS INVOLVING WEATHER AS A CAUSE/FACTOR, US GENERAL AVIATION 1975,

1975 303 p

(PB-267648/4; NTSB-AMM-77-5) Avail: NTIS HC A14/MF A01 CSCL 01B

Reports of 283 fatal U.S. general aviation accidents involving weather as a cause/factor for the year of 1975 are summarized showing the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated on all accidents involving weather as a cause/factor by type of accident, phase of operation, injury index, aircraft damage, pilots certificate, injuries and cause/factor(s). GRA

N77-31120# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS INVOLVING ROTORCRAFT US GENERAL AVIATION, 1975

1975 173 p

(PB-267647/6; NTSB-AMM-77-4) Avail: NTIS HC A08/MF A01 CSCL 01B

Accidents occuring in 1975 involving U.S. general aviation rotorcraft are reported. Included are 309 accident briefs, 26 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N77-31121# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS INVOLVING TURBINE POWERED AIRCRAFT, US GENERAL AVIATION, 1975

1975 76 p

(PB-267646/8; NTSB-AMM-77-3) Avail: NTIS HC A05/MF A01 CSCL 01B

A publication containing reports of U.S. general aviation turbine powered aircraft accidents occurring in 1975 is reviewed. Included are 110 accident briefs, 26 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each acceident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and cause/factor(s). GRA

N77-31122# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS INVOLVING MIDAIR COLLISIONS, US GENERAL AVIATION, 1975

1975 48 p

(PB-267645/0; NTSB-AMM-77-2) Avail: NTIS HC A03/MF A01 CSCL 01B

A publication containing reports of U.S. general aviation midair collision accidents occurring in 1975 is reviewed. Included are 29 accident files, 13 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by kind of flying, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N77-31123# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

LISTINGS OF ACCIDENTS/INCIDENTS BY AIRCRAFT MAKE AND MODEL, US CIVIL AVIATION, 1975

1975 198 p

(PB-267644/3; NTSB-AMM-77-1) Avail: NTIS HC A09/MF A01 CSCL 01B

A publication containing a listing of all U.S. civil aviation accidents/incidents occurring in calendar year 1975, sorted by aircraft make and model is reviewed. Included are the file number, aircraft registration number, date and location of the accident, aircraft make and model and injury index for all 4,431 accidents/incidents occurring in the period. ERA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-31124# National Aviation Facilities Experimental Center, Atlantic City, N. J.

AIR TRAFFIC CONTROL EXPERIMENTATION AND EVALUATION WITH THE NASA ATS-6 SATELLITE. VOLUME 2: DEMONSTRATION OF SATELLITE-SUPPORTED COMMUNICATIONS AND SURVEILLANCE FOR OCEANIC AIR TRAFFIC CONTROL Final Report, Sep. 1974 - Apr. 1975

Francis W. Jefferson Apr. 1976 88 p refs

(FAA-NA-75-64-Vol-2; FAA-RD-75-1732-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 17/7

Demonstrations of satellite supported communications for application to oceanic air traffic control were conducted as part of an international ATS 6 L-band satellite test program. Voice, data, and dependent surveillance communications between air traffic controllers at a ground terminal and pseudopilots in two airborne aircraft were performed via the ATS 6 satellite and ground station. A simulated aircraft terminal was also employed. Each terminal provided up to six simulated data link aircraft, through computer software, for traffic loading purposes. Dependent surveillance was demonstrated through data link automatic aircraft position reports. Position data were obtained from an inertial navigation system and an Omega navigation system in the aircraft. Independent surveillance was demonstrated using the NASA PLACE system and the ATS 6 and ATS 5 satellites. Author

N77-31125*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DESCRIPTION OF THE SOFTWARE ANALYSIS FROM FLIGHT AND SIMULATION DATA OF THE COURSE CUT LIMITER IN THE TCV B-737 AREA NAVIGATION COMPUTER
Charles E. Knox and David A. Hinton Aug. 1977 21 p refs
(NASA-TM-74061) Avail: NTIS HC A02/MF A01 CSCL 17G

During automatic horizontal path captures, the (Terminal Configured Vehicle) B-737 airplane maintained smaller than designed path intercept angles and experienced a sawtooth bank angle oscillation during its turn towards the path. From flight data, it was determined that these anomalies were caused by the improper output of the course cut limiter in the horizontal path control law. The output from the course cut limiter did not obtain its full value and it was calculated stepwise discontinuously. The automatic horizontal path captures were then conducted on the TCV B-737 airplane real-time simulation. The path intercept angles were maintained properly and no bank angle oscillation was encountered. Data showed that the course cut limiter was calculated at its full value in a continuous manner. The intermediate calculations of the course cut limiter in the airplane's navigation computer were rewritten and rescaled in such a manner that truncation errors could be minimized. The horizontal path capture tests were then reflown. The airplane maintained the proper path intercept angle and no bank angle oscillations occurred on any of the tests. Author

N77-31126# Stanford Research Inst., Menlo Park, Calif.
DEFINITION OF A DATA COLLECTION SYSTEM FOR US ARMY TACTICAL MICROWAVE LANDING SYSTEM EVALUATION Final Report, Mar. - Sep. 1976
J. H. Priedigkeit and P. G. Stoltz Sep. 1976 65 p
(Contract DAAB07-75-C-0906)
(AD-A041230; SRI-4462-Suppl; ECOM-75-0906-SF) Avail: NTIS HC A04/MF A01 CSCL 01/2

The data to be collected for flight test performance evaluation of Tactical Microwave Landing System (TMLS) by the Army is defined. Data rates, data formats, and data processing requirements are developed. Data recording options are considered and a preliminary design for a TMLS airborne data collection system is presented. GRA

N77-31127# Naval Research Lab., Washington, D. C.
A SIMPLE CLOSED-FORM SOLUTION OF A POSITION-FIXING PROBLEM Interim Report
Ben H. Cantrell 15 Apr. 1977 10 p
(AD-A039303; NRL-8115) Avail: NTIS HC A02/MF A01 CSCL 17/7

A closed-form solution was obtained for the problem of finding an object's location given ranges to four stations of known location. The method is simple, involving only simple algebra such as addition and multiplication and the evaluation of a few trigonometric functions. Only three stations are required for the solution if some other a priori information is available such as height above the earth or the azimuth. Author (GRA)

N77-31128# Test Group (6585th), Holloman AFB, N. Mexico
PROCEEDINGS OF THE 8TH BIENNIAL GUIDANCE TEST SYMPOSIUM
May 1977 712 p refs Presented at Headquarters 6585th Test Group, Armament Test Center, Holloman Air Force Base, New Mexico, 11-13 May 1977
(AD-A040012; ADTC-TR-77-3-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 17/7

These proceedings contain papers included in the Eighth Biennial Guidance Test Symposium. This symposium, hosted by the Central Inertial Guidance Test Facility, is directed toward the exchange of information, stimulation of new ideas, and discussion of recent developments in the field of guidance testing. The papers presented in these proceedings include such topics as aircraft inertial navigators, strapped-down guidance systems, component evaluation, and analysis techniques. The included papers were those presented in the unclassified sessions of the symposium. Papers presented in the classified portion of the meeting are being published as Volume 2. Author (GRA)

N77-31129# Institute for Defense Analyses, Arlington, Va.
A COMPARISON OF ELECTROOPTICAL TECHNOLOGIES FOR TARGET ACQUISITION AND GUIDANCE: PART 2. ANALYSIS OF THE GRAFENWOEHR ATMOSPHERIC TRANSMISSION DATA Final Report
Lucien M. Biberman, Robert E. Roberts, and Lynne N. Seekamp Jan. 1977 53 p refs
(Contract DAHC15-73-C-0200)
(AD-A040602; P-1218-Pt-2; IDA/HQ-76-18654-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 17/8

In 1975 an ARPA/EUCOM-sponsored Battlefield Target Acquisition Symposium raised questions about electrooptical sensor performance in the winter weather of Central NATO Europe. In response, DDR and E and ARPA launched a set of field trials at Grafenwoehr, Germany. This two-part report presents the findings of those trials. Part 1, classified, presents to DOD activities the results of the equipment evaluations. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-31130*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTICALLY SWEPT ROTOR Patent Application
Fredric H. Schmitz (Army Air Mobility R. and D. Lab., Moffett Field, Calif.), Donald A. Boxwell (Army Air Mobility R. and D. Lab., Moffett Field, Calif.), and C. Rande Vause, inventors (to NASA) (Army Air Mobility R. and D. Lab., Moffett Field, Calif.) Filed 8 Sep. 1977 36 p Sponsored by NASA
(NASA-Case-ARC-11106-1; US-Patent-Appl-SN-831633) Avail: NTIS HC A03/MF A01 CSCL 20A

Impulsive noise reduction is provided in a rotor blade by acoustically sweeping the chord line from root to tip so that the acoustic radiation resulting from the summation of potential singularities used to model the flow about the blade tend to cancel for all times at an observation point in the acoustic far field. NASA

N77-31131*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SURFACE FINISHING Patent Application
Jack A. Kinzler, James T. Heffernan, Leroy G. Fehrenkamp, inventors (to NASA), and William S. Lee Filed 6 Apr. 1977 26 p
(NASA-Case-MSC-12631-2; US-Patent-Appl-SN-785279) Avail: NTIS HC A03/MF A01 CSCL 01C

An airfoil configuration and manufacturing process is described for reducing or eliminating air turbulence created by surface irregularities in the metal due to rivets, wrinkles, butt-joints, and the like. An article adapted for relative motion with a fluid environment is finished by coating the surface with a fluid adhesive, covering the adhesive with a sheet of flexible film material under tension, and setting the adhesive while maintaining tension on the film material so that the tensioned film material is bonded to the surface by the adhesive. NASA

N77-31132*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE DIHEDRAL SHUTTLE ORBITER Patent Application
Bernard Spencer, Jr., John W. Wilkey, Jr., and Beverly Z. Henry, Jr., inventors (to NASA) Filed 8 Oct. 1976 14 p
(NASA-Case-LAR-10706-2; US-Patent-Appl-SN-730780) Avail: NTIS HC A02/MF A01 CSCL 01C

An aircraft configuration is described which yields efficient flight at both subsonic and hypersonic speeds and which permits the wings to be protected from the hostile heat environment of orbital reentry. The essential feature is a variable dihedral wing which may be folded out during flight to adjust the aircraft's flight characteristic as the speed decreases. During hypersonic flight the wings are folded upright against the fuselage, while for the lowest speed operation the wings are fully extended in a horizontal manner. Intermediate positions of extension are used for intermediate speed ranges. NASA

N77-31133*# Princeton Univ., N. J.
AN IN-FLIGHT SIMULATION OF APPROACH AND LANDING OF A STOL TRANSPORT WITH ADVERSE GROUND EFFECT Final Report
David R. Ellis [1976] 58 p refs
(Contract NAS1-11543)
(NASA-CR-154875) Avail: NTIS HC A04/MF A01 CSCL 01C

The results of an in-flight simulation program undertaken to study the problems of landing a representative STOL transport in the presence of adverse ground effects are presented. Landings were performed with variations in ground effect magnitude, ground effect lag, and thrust response. Other variations covered the effects of augmented lift response, SAS-failures, turbulence, segmented approach, and flare warning. The basic STOL airplane required coordinated use of both stick and throttle for consistently acceptable landings, and the presence of adverse ground effects made the task significantly more difficult. Ground effect lag and good engine response gave noticeable improvement, as did augmented lift response. Author

N77-31134*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STUDIES OF FRICTION AND WEAR CHARACTERISTICS OF VARIOUS WIRES FOR WIRE-BRUSH SKIDS
Robert C. Dreher Washington Sep. 1977 32 p refs
(NASA-TN-D-8517; L-11625) Avail: NTIS HC A03/MF A01 CSCL 01C

The friction and wear characteristics of 22 types and sizes of wires for potential use in wire-brush skids were studied. These characteristics were determined by placing brushes made from candidate wires on a belt sander whose moving belt simulated landing roll-out distance. At the same time, the drag force and wear behavior were monitored. Data were obtained over distances up to 3048 m (10,000 ft) at preselected bearing pressures of 172 to 1034 kPa (25 to 150 psi). In general, the friction coefficient developed by the candidate wires was found to be independent of bearing pressure and ranged between 0.4 and 0.6 under the test conditions of this investigation. The friction coefficient was not degraded when the surface was wetted and appears to be independent of wire diameter except perhaps when wire size is relatively large compared with the surface asperities. Generally, the high friction demonstrated by the soft materials was accompanied by high wear rates; conversely, the hard materials provided greater wear resistance but offered lower friction. For all test wires, the wear was shown to increase with increasing bearing pressure, in general, for the same bearing pressure, wear increased with increasing wire diameter and decreased when the surface was wetted. Author

N77-31135*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN IMPROVED FREE WING FOR AN AIRCRAFT Patent Application
Chester H. Wolowicz, inventor (to NASA) Filed 8 Sep. 1977 20 p
(NASA-Case-DFRC-10092-1; US-Patent-Appl-SN-831634) Avail: NTIS HC A02/MF A01 CSCL 01C

A free wing is attached to a fuselage of an aircraft in a manner such that the wing is free to pivot about a spanwise axis forward of its aerodynamic center. The wing is angularly displaced about the axis by aerodynamic pitching moments, resulting from lift, and is trimmed through a use of a trimmable free stabilizer comprising a floating canard mounted on a strut rigidly connected to the wing and forwardly projected therefrom. NASA

N77-31136# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
AIRWORTHINESS AND FLIGHT CHARACTERISTICS EVALUATION C-12A AIRCRAFT Final Report, 25 Oct. 1975 - 14 Feb. 1976
Joseph C. Watts, Vernon L. Diekmann, Raymond B. Smith, John E. Hannon, and William A. Horton Oct. 1976 203 p
(AD-A040239; USAAEFA-75-08) Avail: NTIS HC A10/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted an airworthiness and flight characteristics evaluation of a C-12A aircraft, serial number 73-22250, from 25 October 1975 through 14 February 1976. The aircraft was tested at Edwards Air Force Base (field elevation 2302 feet), Paso Robles (field elevation 836 feet), and Lake Tahoe (field elevation 6262 feet), California. During the evaluation 71 flights totaling 68.75 productive flight hours were conducted. Performance and handling qualities of the C-12A were evaluated under a variety of operating conditions with emphasis on operation in the normal mission configuration near the maximum gross weight of 12,500 pounds. The test aircraft was evaluated against the requirements of Federal Aviation Regulation Part 23, the Beech Aircraft Corporation prime item development specification, and military specification MIL-F-8785B(ASG) to assist in determining operational mission capabilities. Two handling qualities deficiencies were identified. These were the main landing gear wheel lock up tendency which occurred when applying brakes during landing, and the lack of adequate stall warning above 20,000 feet pressure altitude. Twenty shortcomings were noted including four stability and control shortcomings, two lighting system shortcomings, and 14 reliability and maintainability shortcomings. The C-12A failed to meet the single-engine service ceiling, dual-engine cruise ceiling, and the 30,000-foot altitude cruise airspeed guarantees. Two enhancing features were the location of the landing light switches and the rudder boost, which greatly reduced pilot workload during asymmetric power conditions.
Author (GRA)

N77-31137# Naval Air Test Center, Patuxent River, Md.
FLIGHT CONTROL TESTING OF THE VAK-191B AIRCRAFT
Robert L. Traskos 24 May 1977 8 p refs
(AD-A040535; NATC-TM-77-1-SA) Avail: NTIS HC A02/MF A01 CSCL 01/3

The U.S. Navy/Federal Republic of Germany Joint Flight Test Program, using the VAK-191B aircraft, was conducted to expand the base of VSTOL technology. During the flight program, an integrated test block approach was considered mandatory for the acquisition of the required data in the limited flight time available. Ground and captive rig tests were used, when applicable, to supplement data acquisition. In spite of the configuration of the captive rig, which precluded its use in the documentation of engine exhaust flow, it was considered a valuable tool in control system and engine test, and for pilot familiarization.
Author (GRA)

N77-31138# Army Air Mobility Research and Development Lab., St. Louis, Mo. Systems Research Integrated Office.
SINGLE-ROTOR HELICOPTER DESIGN AND PERFORMANCE ESTIMATION PROGRAMS. VOLUME 1: METHODOLOGY Final Report
Milton A. Schwartzberg, Roger L. Smith, James L. Means, Harold Y. H. Law, and David P. Chappell Jun. 1977 91 p refs
(AD-A040803; SRIO-77-1-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 01/3

Computer programs, designated SSP-1 and SSP-2, have been prepared for: (1) the preliminary design of single-rotor helicopters to meet specified mission requirements, and (2) the estimation of the performance of single-rotor helicopters of known geometry and with known engine characteristics. The present volume is

one of a series describing those computer programs. It details the methodology on which all of those programs are based.
Author (GRA)

N77-31139# Logistics Management Inst., Washington, D. C.
SENSITIVITY OF ARMY HELICOPTER OPERATING AND SUPPORT COSTS TO CHANGES IN DESIGN AND LOGISTIC PARAMETERS
John D. Forster May 1977 54 p refs
(Contract SD-321)
(AD-A040353; LMI-75-1/4) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study assesses Army helicopter O and S costs and Support Investment (SI) costs in order to assure that the degree of hardware design and logistic parameter sensitivity included in cost estimates accurately reflects actual expenditure sensitivities. Army O and S cost data sources, methodology, and approaches are examined, and selected cost improvements isolated and evaluated. Strengths of the current costing structure are noted so that they can be carried forward and improved upon to assure accurate representation of new systems to the DSARC. O and S data sources reviewed include reliability, maintainability, and field reported cost data. The present methodology and approaches for both Baseline (Program Manager's) Cost Estimates (BCE) and Independent Parametric Cost Estimates (IPCE) are assessed. The dominant O and S costs are found to be Manpower, Replenishment Spares, and Initial Spares. For Manpower and Initial Spares, simplified models are discussed which give OASD visibility into the critical sensitivities of Army helicopter O and S costs. Of the parameters examined for the selected helicopters, O and S costs are most sensitive to the Mean Time Between Dynamic Component Removals (MTBRDC). The report concludes with a discussion of bounding values of Army helicopter O and S cost that can be expected if extreme values of critical O and S cost driving parameters, including those assumed in the cost estimate's approach, are encountered in actual practice. GRA

N77-31140# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT Semiannual Summary Report, 1 Jan. 1962 - 31 Dec. 1976
Alan M. Kaniss 1 May 1977 159 p Revised
(AD-A041266) Avail: NTIS HC A08/MF A01 CSCL 01/2

This is a semi-annual progress report, and it presents a specialized summary of the data in the counting accelerometer program. Statistics describing Navy and Marine aircraft cumulative g-count exceedances are calculated and tabulated. These tabulations are separated by calendar time and into four major categories of fleet experience: Navy Training, Navy Combat, Marine Training, and Marine Combat. These data show that the load rate distributions (counts at 1000 hours) for most models and most g-levels have a non-normal distribution. Within a model (F-4B, F-8H, etc.) differences in the average load rates exist when data are separated by calendar time or mission category.
Author (GRA)

N77-31141# Boeing Aerospace Co., Seattle, Wash. Military Airplane Development.
INNOVATIVE AIRCRAFT DESIGN STUDY (IADS) TASK 2, VOLUME 1 Final Report
E. A. Barber, D. G. Blattner, R. C. Sutton, and M. J. Mailhiot Jun. 1977 186 p refs
(Contract F33615-76-C-0122)
(AD-A041234) Avail: NTIS HC A09/MF A01 CSCL 01/3

The study was concerned with the conceptual design and evaluation of military heavy logistics transport aircraft entering service in the 1990-2000 time period. Design paylaods of 200,000-600,000 lb. and design ranges of 3600-7200 nm were considered. Takeoff field length was 8,000 ft. in most cases. Suitability for commercial usage was a major objective. Computer aided design techniques were employed extensively for airplane synthesis and analysis. The study was accomplished in two phases. Phase I included parametric design and analysis of transports in the payload/range categories cited above. An advanced technology review, including evaluations and sensitivity analyses, was accomplished. These studies indicated that substantial gains were possible in reducing operating costs by incorporating both the low risk technology and innovative designs available in 1985, and advanced technology such as composite structures available at a later time. Additional effort is required to identify this increased cost of higher risk advanced technology to determine its cost effectiveness. In Phase II, a baseline mission requiring 3600 nm radius and 400,000 lb. payload was selected. GRA

N77-31142# Army Aviation Systems Command, St. Louis, Mo. Systems Analysis Office.
CH-47 MEDIUM LIFT HELICOPTER EFFECTIVENESS EVALUATION PROGRAM RUN BOOK Final Report
Mark E. Barkley and John A. Weaver Jun. 1977 37 p refs
(AD-A041462; DRSAV-D-77-10/2; USAAVSCOM-TR-77-31)
Avail: NTIS HC A03/MF A01 CSCL 01/3

This report offers a general description of the Medium Lift Helicopter Effectiveness Evaluation Program, instructions for preparing input data and job control language (JCL) card decks, and for consolidating these decks. It also offers definitions of the input/output variables, a listing of the JCL, a sample output listing, and a glossary of the terms used. Author (GRA)

N77-31143# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
COMPARATIVE PERFORMANCE MEASUREMENTS OF TWO HELICOPTER BLADE PROFILES IN HOVERING FLIGHT
M. J. Riley and P. Brotherhood London Aeron. Res. Council 1977 55 p refs Supersedes RAE-TR-74008; ARC-35289
(ARC-R/M-3792; RAE-TR-74008; ARC-35289) Avail: NTIS HC A04/MF A01; HMSO £5; PHI

A new blade profile, RAE(NPL)9615, was developed for the Lynx helicopter using two-dimensional aerfoil tests. The complex nature of the rotor environment makes it essential to confirm that the designed improvements are realized in flight. The present tests, planned before the Lynx first flew, have simultaneously compared the new profile with the NACA 0012 profile in hovering flight. Each profile took the form of a fairing or 'glove' on a pair of opposing blades of the Wessex helicopter and both local surface pressures and wake pitot pressures were measured. The flight results confirm the comparative reduction in local supersonic velocity and in shock-induced profile drag for the new profile. However, differences between flight and tunnel attributable to three-dimensional effects are evident. The results also indicate the complex nature of the flow due to blade vortex interaction and small translation velocities. Author (ESA)

N77-31144# Naval Air Test Center, Patuxent River, Md.
SUMMARY OF HELICOPTER AIRFRAME TESTING IN THE SHIPBOARD ENVIRONMENT
Herman G. Kolwey 29 Apr. 1977 12 p refs
(AD-A039748; NATC-TM-77-2RW) Avail: NTIS HC A02/MF A01 CSCL 01/3

This paper presents a summary of test results from several helicopter shipboard test programs. Data are presented from the HH-2D test on the FF-1052 class USS W.S.SIMS in 1970, the SH-2F on the FF-1052 class USS BOWEN in 1974, and the HH-3F on the WHEC Class USCG HAMILTON in 1975. Improvements in NATOPS manual information are highlighted in the areas of wind and/or airspeed limitations, cockpit indications, and helicopter performance information for both level flight and climb and descent. Shipboard deck strength and landing gear capabilities are addressed and a statistical data base is presented from which extrapolations to the sea state 5 environment may be made. Author (GRA)

N77-31145# Naval Postgraduate School, Monterey, Calif.
A STUDY OF SPECTRUM LOADING AND RANGE-PAIR COUNTING METHOD EFFECTS ON CUMULATIVE FATIGUE DAMAGE M.S. Thesis
John Scott Atkinson, Jr. Mar. 1977 118 p refs
(AD-A039651) Avail: NTIS HC A06/MF A01 CSCL 01/3

This thesis is a study of cumulative fatigue damage. Variations in cumulative fatigue damage resulting from block loading spectra and randomized cycle loading spectra are investigated. Fatigue damage results show the merit of counting load cycles using the range-pair counting method. Complete FORTRAN computer program documentation enables this thesis to serve as a program user's manual. Author (GRA)

N77-31146# Rockwell International Corp., Columbus, Ohio. Missile Systems Div.
ARPV SYSTEM/DESIGN TRADE STUDY. VOLUME 4: LAUNCH AND RECOVERY
26 Apr. 1976 162 p
(Contract F33657-75-C-0518)
(AD-A039591; C76-1324/034C-Vol-4) Avail: NTIS HC A08/MF A01 CSCL 01/3

On the basis of trade-off analysis of Launch and Recovery Systems for ARPV, the conventional take-off and landing method using high lift wing (STOL) technique, own thrust and arresting gear system emerged as the undisputable leader among the candidate systems. The next system in succession is the STOL configuration using modified SATS catapult conventional gear and arrester gear. The third best system comes out to be a STOL CONFIGURATION - WHEELED DOLLY (STEERABLE) ARRESTER GEAR and INTEGRAL AIR CUSHION. In the fourth place (again in absence of cheap SATS catapults), the Hybrid Truck Launcher with STOL and Arrester Gear SKIDS is the final viable candidate which can be effective as a tactical ARPV system Launch and Recovery Method. GRA

N77-31075*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEPARATED-FLOW UNSTEADY PRESSURES AND FORCES ON ELASTICALLY RESPONDING STRUCTURES
C. F. Coke, D. W. Riddle, and C. Hwang (Northrop Corp., Hawthorne, Calif.) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 25 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01 CSCL 01C

N77-31077# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE DYNAMIC RESPONSE OF WINGS IN TORSION AT HIGH SUBSONIC SPEEDS
G. F. Moss and D. Pierce *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 21 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-31147# Air Force Instrument Flight Center, Randolph AFB, Tex.
ALTITUDE WARNING SIGNAL SYSTEM EVALUATION Final Report
Kenneth J. Kerkering, Gerald C. Armstrong, and Dolores M. Tyler Apr. 1977 23 p
(AD-A039365; USAFIFC) Avail: NTIS HC A02/MF A01 CSCL 01/4

The Research and Development Division, USAF Instrument Flight Center (USAFIFC/RD) conducted a pilot factors evaluation of the Harowe Altitude Warning Signal System (AWSS) to determine its acceptability for use in Air Force aircraft. The system has the primary function of assisting pilots in attaining and maintaining assigned or desired (command) altitudes. A secondary function, the approach mode, was incorporated in the AWSS to examine the concept of altitude warning during landing approaches. Thirteen sorties were flown in a NT-38 Talon. Subject pilots were selected from IFC personnel. The overall concept and operation was found to be acceptable by half of the subject pilots. Half of the subject pilots felt the information provided by the system did not justify the increased workload. The normal and approach modes of operation were found to be acceptable in concept, operation, and accuracy. The system in its present configuration is not acceptable for installation in trainer and single place aircraft due to the unacceptable increase in cockpit workload. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-31148*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
THE EFFECT OF AMBIENT CONDITIONS ON CARBON MONOXIDE EMISSIONS FROM AN IDLING GAS TURBINE COMBUSTOR M.S. Thesis
Anand K. Subramaniam 1977 99 p refs
(Grant NsG-3045)
(NASA-CR-154986) Avail: NTIS HC A05/MF A01 CSCL 21E

A test program employing a gas turbine combustor is outlined; the results of which quantize the effects of changes in ambient temperature and humidity on carbon monoxide emissions at simulated idle operating conditions. A comparison of the experimental results with analytical results generated by a kinetic model of the combustion process, and reflecting changing ambient conditions, is given. It is demonstrated that for a complete range of possible ambient variations, significant changes do occur in the amount of carbon monoxide emitted by a gas turbine at idle, and that the analytical model is reasonably successful in predicting changes. Author

N77-31149*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
NASA/NAVY LIFT/CRUISE FAN. PHASE 1: DESIGN SUMMARY
Sep. 1977 276 p refs
(Contract NAS3-20046)
(NASA-CR-135242; R77AEG180) Avail: NTIS HC A11/MF A01 CSCL 21E

The initial design of the LCF459 lift/cruise fan system is documented. The LCF459 is a 1.5 meter diameter turbotip lift/cruise fan whose design point pressure ratio is 1.32 at a tip speed of 353 meters per second. The gas source for the tip turbine is the YJ97-GE-100 engine. Author

N77-31150# Federal Aviation Administration, Washington, D. C.
NOISE LEVELS FOR TURBOJET POWERED AIRPLANES AND LARGE PROPELLOR DRIVEN AIRPLANES: NOTICE OF PROPOSED RULE MAKING
2 Aug. 1976 81 p refs
Avail: NTIS HC A05/MF A01 CSCL 20A

A proposed amendment to Part 36, Appendix C of the Federal Aviation regulations covering turbojet powered and subsonic large propeller driven airplanes is discussed. Effective perceived noise levels are listed for available and future technology aircraft at sideline, takeoff, and approach. Author

N77-31151# Southampton Univ. (England).
A COMPUTER SIMULATION OF A STARTING-JET
A. V. J. Edwards, C. L. Morfey, and P. O. A. L. Davies Apr. 1977 31 p refs
(ISVR-89) Avail: NTIS HC A03/MF A01

A discrete vortex model of an axisymmetric starting jet is presented. Since the model used is axisymmetric, the flow and turbulence simulated are therefore similarly constrained. The evolution of axisymmetric turbulence, in space and time, under certain boundary conditions is shown. The boundary conditions are chosen to represent a starting jet of circular cross-section. The properties of the simulated starting jet are compared with measurements in a real jet. Author

N77-31152*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC AND DIRECTIONAL ACOUSTIC PERFORMANCE OF A SCOOP INLET
John M. Abbott and Donald A. Dietrich Sep. 1977 28 p refs

(NASA-TP-1028; E-9134) Avail: NTIS HC A03/MF A01 CSCL 21E

Aerodynamic and directional acoustic performances of a scoop inlet were studied. The scoop inlet is designed with a portion of the lower cowling extended forward to direct upward any noise that is propagating out the front of the engine toward the ground. The tests were conducted in an anechoic wind tunnel facility at free stream velocities of 0, 18, 41, and 61 m/sec and angles of attack from -10 deg to 120 deg. Inlet throat Mach number was varied from 0.30 to 0.75. Aerodynamically, at a free stream velocity of 41 m/sec, the design throat Mach number (0.63), and an angle of attack of 50 deg, the scoop inlet total pressure recovery was 0.989 and the total pressure distortion was 0.15. The angles of attack where flow separation occurred with the scoop inlet were higher than those for a conventional symmetric inlet. Acoustically, the scoop inlet provided a maximum noise reduction of 12 to 15 db below the inlet over the entire range of throat Mach number and angle of attack at a free-stream velocity of 41 m/sec. Author

N77-31153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF TEMPERATURE TRANSIENTS AT FAN INLET OF A TURBOFAN ENGINE

Mahmood Abdelwahab Sep. 1977 40 p refs

(NASA-TP-1031; E-0162) Avail: NTIS HC A03/MF A01 CSCL 21E

The effects of fan inlet temperature transients on the performance and stability of a turbofan engine were determined. The experiment was conducted at 90 and 74 percent of low-pressure-rotor military speed (9525 rpm) and with fan inlet temperature distortions having circumferential extents of 90 deg, 180 deg, 270 deg, and 360 deg. Temperature transients were controlled by varying the magnitude and rate of change of the inlet temperature rise. The engine response ranged from a momentary compressor pressure disturbance to low-pressure-compressor stall. The compressor distortion limits decreased with decreasing low-pressure-rotor speed and increased with increasing circumferential extent of distortion. Analysis of the data suggests strongly that the distortion limits of the compressor are a function of a critical magnitude of inlet temperature rise and are independent of the temperature rise rate. Author

N77-31154*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPMENT AND VERIFICATION OF REAL-TIME, HYBRID COMPUTER SIMULATION OF F100-PW-100(3) TURBOFAN ENGINE

John R. Szuch, Kurt Seldner, and David S. Cwynar Sep. 1977 75 p refs

(NASA-TP-1034; E-9090) Avail: NTIS HC A04/MF A01 CSCL 21E

A real time, hybrid computer simulation of a turbofan engine is described. Controls research programs involving that engine are supported by the simulation. The real time simulation is shown to match the steady state and transient performance of the engine over a wide range of flight conditions and power settings. The simulation equations, FORTRAN listing, and analog patching diagrams are included. Author

N77-31155*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADVANCED TURBOPROP TECHNOLOGY DEVELOPMENT

J. F. Dugan, D. P. Bencze, and L. J. Williams 1977 39 p refs Presented at Aircraft Systems and Technol. Meeting, Seattle, 22-24 Aug. 1977; sponsored by AIAA

(NASA-TM-73729; E-9290) Avail: NTIS HC A03/MF A01 CSCL 21E

The efficiency of high-speed turboprop propulsion systems is considered with emphasis on fuel savings. Specific topics discussed include: (1) high efficiency and low noise of propeller design; (2) fuselage noise attenuation; (3) propeller and gear box maintenance; and (4) engine-airframe integration. J.M.S.

N77-31156*# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.

PROPELLER STUDY. PART 1: INTRODUCTION AND OVERVIEW

Allen I. Ormsbee Jul. 1977 16 p 3 Vol.

(Grant NGR-14-005-194)

(NASA-CR-155002; AAE-77-12-Pt-1; UILU-ENG-77-0512-Pt-1) Avail: NTIS HC A02/MF A01 CSCL 01C

A general aerodynamic-acoustic theory was developed for determining the acoustical design of propellers used on general aviation aircraft. Data from the theoretical investigation were applied in the design of a propeller whose thrust and torque were measured during a series of YO-3A aircraft flight tests. Author

N77-31157*# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.

PROPELLER STUDY. PART 2: THE DESIGN OF PROPELLERS FOR MINIMUM NOISE

Allen I. Ormsbee and Chung-Jin Woan Jul. 1977 203 p refs 3 Vol.

(Grant NGR-14-005-194)

(NASA-CR-155005; AAE-77-13-Pt-2; UILU-ENG-77-0513-Pt-2) Avail: NTIS HC A10/MF A01 CSCL 01C

The design of propellers which are efficient and yet produce minimum noise requires accurate determinations of both the flow over the propeller. Topics discussed in relating aerodynamic propeller design and propeller acoustics include the necessary approximations and assumptions involved, the coordinate systems and their transformations, the geometry of the propeller blade, and the problem formulations including the induced velocity, required in the determination of mean lines of blade sections, and the optimization of propeller noise. The numerical formulation for the lifting-line model are given. Some applications and numerical results are included. Author

N77-31158*# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.

PROPELLER STUDY. PART 3: EXPERIMENTAL DETERMINATION OF THRUST AND TORQUE ON THE YO-3A AIRCRAFT

Allen I. Ormsbee, S. A. Siddiqi, and K. R. Sivier Sep. 1977 60 p refs 3 Vol.

(Grant NGR-14-005-194)

(NASA-CR-155003; AAE-77-14-Pt-3; UILU-ENG-77-0514) Avail: NTIS HC A04/MF A01 CSCL 01C

Instrumentation and procedures for obtaining in-flight measurements of the torque and thrust of a propeller mounted on a YO-3A aircraft are described. Problems encountered in the study are discussed and methods for eliminating these difficulties are suggested. Author

N77-31159# Pennsylvania State Univ., State College. Applied Research Lab.

THE DESIGN AND EVALUATION OF SCREENS TO PROVIDE MULTICYCLE 20% AMPLITUDE SINUSOIDAL VARIATIONS IN THE AFRF ROTOR INLET AXIAL VELOCITY COMPONENT

Edgar P. Bruce 8 Jan. 1974 81 p refs

(Contract N00017-73-C-1418)

(AD-A040671; TM-74-16) Avail: NTIS HC A05/MF A01 CSCL 21/5

This memorandum describes the results of an effort initiated in April 1973, whose objective was to provide new disturbance-producing screens for use in the Axial Flow Research Fan (AFRF). The performance of the screens originally developed for use in this facility was characterized by the generation of axial velocity profiles whose maximum and minimum values differed from the mean value by approximately 6% and by the presence of harmonics whose amplitude was on the order of 20% of the amplitude of the fundamental. The new screens were designed to produce axial velocity profiles with variations about the mean value of plus or minus 20%, and care was exercised in the selection of materials and in the assembly of the screens in an attempt to reduce the amplitude of the other harmonics relative to the amplitude of the fundamental. Results are presented for one-, two-, four-, six-, nine-, and fifteen-cycle screens which show that the design objectives were met to within a few percent. In addition, appendices are included which: (1) describe the

performance characteristics of the original one-cycle screen, (2) define a modified approach and the design characteristics adopted to permit fabrication of twelve- and fifteen-cycle screens, and (3) contain design charts that are useful in the selection of the screening materials required in a development program of this type. Author (GRA)

N77-31160# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Productions Div.

TURBINE ENGINE LOADS SIMULATOR (TELS) RADIOGRAPHIC SYSTEMS Final Report, 1 Mar. 1976 - 28 Feb. 1977

Bruce E. Kinchen Jun. 1977 202 p

(Contract F40600-76-C-0008)

(AD-A040465; PWA-FR-8496; AEDC-TR-77-55) Avail: NTIS HC A19/MF A01 CSCL 21/5

An analytical program was conducted to define the radiographic requirements necessary for the implementation of a radiographic system in a Turbine Engine Loads Simulator (TELS) facility. Data from the TELS studies provided the flight conditions which were used to determine the rotor case deflections of the engine under load. Source positioning and areas to be radiographed were located by analyzing the gyroscopic moments acting on the engine during centrifuge operation. An X-radiation source to measure internal clearances was selected after relationships between radiographic requirements and source parameters were established. Two-radiographic system concepts, on-centrifuge and off-centrifuge, were evaluated for integration into the TELS system. The on-centrifuge concept was selected because of its potential in offering more flexibility in source positioning. This concept locates as many of the critical components as possible near the center of rotation of the centrifuge and utilizes a linear accelerator with RF power. To implement the on-centrifuge concept in the TELS facility, preliminary design requirements were identified and recommendations for further study made. Author (GRA)

N77-31161# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

ADVANCED COOLED TURBINE AIRFOIL AERODYNAMIC INVESTIGATION Final Report, 15 Sep. 1975 - 30 Jan. 1977

W. G. Hess Feb. 1977 55 p

(Contract F33615-76-C-2009)

(AD-A041137; AFAPL-TR-76-113) Avail: NTIS HC A04/MF A01 CSCL 21/5

Several convectively cooled trailing edge designs were investigated with the objective of eliminating the need for film cooling on the airfoil suction side. A 43.4% reduced solidity first stage turbine vane having potential application for an advanced Air Force fighter engine was selected for the evaluation. The final design eliminates film cooling on the suction side and uses the wavy criss-cross slot as the cooling scheme for the trailing edge section. The cooling design was incorporated into a cascade test airfoil using the radial wafer fabrication technique. The airfoil was constructed by photoetching the cooling design into the individual wafers, bonding the wafers together and machining the bonded block into the airfoil shape. The airfoil was subsequently evaluated in an airfoil cascade test to determine the aerodynamic and cooling performance. The aerodynamic profile loss of the reduced solidity radial wafer airfoil was reduced 56% relative to a baseline 43.4% reduced solidity configuration with film cooled suction surface and was 30% under the program goal. The wavy criss-cross slot design used in the trailing edge section proved to be an efficient cooling technique, and eliminated the need for suction side film cooling. GRA

N77-31162# Thermal Technology Labs., Buffalo, N. Y.

DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES Interim Report, Jan. 1975 - Jun. 1976

D. L. Lockwood, R. I. McNall, Jr., and R. L. Haumesser Dec. 1976 90 p refs

(Contract F33615-75-C-2014; AF Proj. 3145)

(AD-A041515; AFAPL-TR-76-102) Avail: NTIS HC A05/MF A01 CSCL 09/1

Several major developments have occurred in this program. As is often the case in research, they did not occur exactly in accordance with the original plan. The total program however is essentially on schedule. New techniques for fabrication of pie wound transformers were developed which yielded superior designs. This development was followed by the development of computer aided design programs for pie wound transformers. Several 10KW transformers have been fabricated and subjected to a variety of tests. Based on the results of these tests both the 10KW and 200 KW transformers will be pie rather than layer wound. A 10KW transformer rectifier system is presently being integrated with a breadboard inverter for final verification. During the first half of this program, a numerical method was developed for the solution of the nonlinear lumped parameter transformer model. This model was developed under the previous contract, but no stable solution had been found. The present solution is for a resistive load and work is continuing to include leakage inductance, shunt capacitance, and an arbitrary load impedance. The present program has been implemented on the HP 9830 machine. As mentioned above, pie wound transformer design programs have been written. These are for interactive design on the HP 9830 and are not self optimizing routines. A decision should be made as to the ultimate application of these programs before a decision whether or not to implement them on the CDC 6600 is reached. GRA

N77-31163# Rolls-Royce Ltd., Derby (England).

FAN SUPERSONIC FLUTTER: PREDICTION AND TEST ANALYSIS

D. G. Halliwell London Aeron. Res. Council 1977 24 p refs Supersedes ARC-36374

(ARC-R/M-3789; ARC-36374) Avail: NTIS HC A02/MF A01; HMSO £3; PHI

The aerodynamic and vibration characteristics of unstalled supersonic flutter in fan assemblies having part-span shrouds or clappers are described. It is briefly compared and contrasted with stall flutter. The importance of frequency and modeshape analyses is stressed and supersonic flutter prediction methods are examined, commencing with the modeshape parameter. Unsteady work theory leads to the study of aerodynamic damping with the prediction of flutter mode, speed and wave direction. Throughout, emphasis is given to the support of design analysis by test data, from laboratory measurements on stationary models to full scale engine altitude test chamber behavior. Finally, the effect on flutter of some of the opening criteria in engine service is considered. Author (ESA)

N77-31164# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

INLET FLOW DISTORTIONS IN AXIAL FLOW COMPRESSORS

Jean Colpin Feb. 1977 35 p refs

(VKI-TN-122) Avail: NTIS HC A03/MF A01

Analyses of the inlet circumferential flow distortion problems of axial flow compressors are considered. A global analysis develops the parallel compressor model by including an unsteady blade transfer function, which depends essentially on the blade reduced frequency. Thus, small distortions are taken into account for the highly unsteady behaviors they induce at the rotor. The predictions reached agree fairly well with various upstream grids. A simple two-dimensional incompressible model is presented to simulate the rotor dynamic transfer. On this established basis, fundamental parameters involved in the unsteady transfer are extracted. Detailed measurements corroborate the conclusions made through the model, showing various dynamic transfer fin function of the distortion extents and of the peripheral velocity. Author (ESA)

N77-31165# Loughborough Univ. of Technology (England). Dept. of Mathematics.

TWO-POINT BOUNDARY VALUE PROBLEMS IN THE OPTIMAL CONTROL DESIGN OF TURBINE BLADES

B. M. E. DeSilva, D. R. Green, and G. N. C. Grant Jan. 1976 17 p refs

(MATHS-Res-88) Avail: NTIS HC A02/MF A01

Methods for handling some highly nonlinear differential equations in the complex domain arising in the structural optimization of turbine blades are described. The optimal control formulations are based on a combination of second variation methods and quasilinearization of the describing differential equations. These representations are characterized by in-

homogeneous matrix differential equations of the Riccati type and generation of minimizing control functions to be incorporated into the linearized state and adjoint equations. Some computational difficulties encountered in the solution of these two-point problems, some of which exhibit stiff behavior, are discussed, using a shooting method with Newton iterations. Author (ESA)

N77-31166# Loughborough Univ. of Technology (England). Dept. of Mathematics.

COMPARISON OF SOME OPTIMAL CONTROL METHODS FOR THE DESIGN OF TURBINE BLADES

B. M. E. DeSilva and G. N. C. Grant Apr. 1976 55 p refs (MATHS-Res-96) Avail: NTIS HC A04/MF A01

Some numerical methods for the optimal control design of turbine blades, the vibration characteristics of which are approximated by Timoshenko beam idealizations with shear and incorporating simple boundary conditions, were compared. The blade was synthesized using the following methods: (1) conjugate gradient minimization of the system Hamiltonian in function space incorporating penalty function transformations; (2) projection operator methods in a function space which includes the frequencies of vibration and the control function; (3) epsilon-technique penalty function transformation resulting in a highly nonlinear programming problem; (4) finite difference discretization of the state equations again resulting in a nonlinear program; (5) second variation methods with complex state differential equations to include damping effects resulting in systems of inhomogeneous matrix Riccati equations some of which are stiff; (6) quasilinear methods based on iterative linearization of the state and adjoint equation. Some computation difficulties encountered in the implementation of these techniques are discussed. Work in progress using a differential dynamic programming approach is presented and discussed. Author (ESA)

N77-31167# Aeronautical Research Council, London (England).

EXPERIENCE OF THE DENTON BLADE-TO-BLADE TIME MARCHING COMPUTER PROGRAMS

J. D. Bryce and M. R. Litchfield 1977 25 p refs Supersedes ARC-36909

(ARC-CP-1373; ARC-36909) Avail: NTIS HC A02/MF A01; HMSO £1.50; PHI

The Denton two-dimensional and three-dimensional time marching blade-to-blade computer programs were used at NGTE to analyze the flow past transonic turbine blading. Experience has been gained in operating the programs and the major findings in respect of how the programs have performed are described. Solutions for several blade sections, giving Mach number distribution, are included. Author (ESA)

N77-31168# California Research and Technology, Inc., Woodland Hills.

NUMERICAL ANALYSES OF SOFT BODY IMPACTS ON RIGID AND DEFORMABLE TARGETS Interim Technical Report, Jul. - Dec. 1975

M. Rosenblatt, G. E. Eggum, L. A. DeAngelo, and K. N. Kreyenhagen Dec. 1976 96 p refs

(Contract F33615-75-C-5052)

(AD-A040030; AFML-TR-76-202) Avail: NTIS HC A05/MF A01 CSCL 21/5

A two-dimensional finite difference code, WAVE-L, was used to investigate the impact of soft bodies (birds) on both rigid and deformable targets. The soft body was numerically modeled as a water sphere. Three impact cases were examined: impacts onto rigid targets (both normal and oblique), impact onto a deformable target (a stainless steel disk) and impact onto the edge of a typical jet engine fan blade. For the impacts onto rigid targets the finite difference calculation was used to obtain the pressures produced at impact, the distribution of pressure over the target and the total force exerted on the target. These calculations were compared with experimentally measured values. The impact onto a stainless steel disk was also modeled with the finite difference code. Plate deformation, impact pressures and forces were calculated. The fan blade impacts were modeled in two phases. The impact loading pressures and forces were calculated with the finite difference model. The blade was then modeled with a three dimensional finite element code, NON-SAP, using the finite difference pressures on impact.

Author (GRA)

N77-31169# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Science.

RESEARCH ON NOISE GENERATED BY DUCTED AIR-FUEL COMBUSTION SYSTEMS Final Report, Mar. 1971 - Mar. 1977

E. G. Plett and M. Summerfield Mar. 1977 32 p refs

(Contracts N00014-67-A-0151-0029; N00014-75-C-0507)

(AD-A039957; AMS-1327) Avail: NTIS HC A03/MF A01 CSCL 21/5

Throughout the research program, emphasis has been placed on obtaining a better understanding of the importance of combustion as a source of noise in jet engines. This has been pursued in terms of theoretical modeling and experimental investigations. A theoretical model was developed to allow computation of the role internal sources as well as external sources. Calculations based on reasonable approximations indicated that for subsonic jet velocities, internal sources could be much more important than the jet noise sources. Experiments in a cold flow with cylindrical struts immersed in the flow to generate unsteadiness demonstrated this effect. More to the point, experiments with a ducted combustor also verified that the combustion, though occurring inside the duct, causes unsteadiness in the exhaust flow which is directly responsible for noise generation. The noise thus attributable to the combustion was found to be dominant over jet noise for subsonic jets to Mach numbers of approximately 0.6. A unified theory of combustion noise generation was developed. Direct verification of the importance of the various source terms was begun. Initial results suggest that at least several of the terms are important.

GRA

N77-31170# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

CALCULATION OF SIDE LINE NOISE LEVELS DURING TAKEOFF Technical Report, Aug. - Sep. 1976

John F. Mills Sep. 1976 30 p refs

(Contract F33615-76-C-0507)

(AD-A040624; BBN-3298; AMRL-TR-76-123) Avail: NTIS HC A03/MF A01 CSCL 01/5

This report discusses an improved analytical approach for computing the sideline noise generated by aircraft during takeoff roll. The relationship accounts for the effects of acceleration on the typical shape of noise radiation pattern from a static full-power ground runup. This simplified model is suitable for hand calculations or direct implementation into NOISEMAP, the computerized procedure used by the Air Force to generate contours of equal noise exposure about airbases resulting from aircraft flight and ground runup operations. For the Boeing 707-300 aircraft, the new, simplified model yielded results within 0.5 db of those obtained with more complex computational procedures involving the effects of forward speed on the jet noise output. GRA

N77-31171# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.

DEVELOPMENT OF A CATALYTIC COMBUSTOR FOR AIRCRAFT GAS TURBINE ENGINES Final Technical Report, 22 May 1975 - 22 Sep. 1976

Vincent J. Siminski and Henry Shaw 22 Sep. 1976 166 p refs

(Contract F33615-75-C-2033)

(AD-A040135; EXXON/GRU.1BFA.76; AFAPL-TR-76-80) Avail: NTIS HC A08/MF A01 CSCL 21/5

The pollution problems associated with unburned hydrocarbons and carbon monoxide in the idle mode, and NOx and smoke production in the power mode of aircraft gas turbine operation can be minimized using hybrid catalytic combustion. A hybrid catalytic combustor consists of a fuel-rich precombustor, secondary air quenching zone, and monolithic catalyst stage which rapidly oxidizes CO and UHC produced in the pre-combustor. The concentration of thermally-produced NOx in the pre-combustor is very low because of the lack of oxygen. However, the formation of NOx precursors such as HCN and NH3 produced under fuel rich conditions must be considered. Data showed that nitrogeneous species produced in the rich pre-combustion zone were efficiently converted to NOx by catalysts under the very lean mixture conditions that result from the secondary air quench. The equivalence ratio in the pre-combustor was varied from 0.5 to

1.5, while the overall mixture, after secondary air injection, was in the range of 0.1 to 0.3. GRA

N77-31172# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DIGITAL SHAFT ENCODER Final Technical Report, Feb. 1974 - Oct. 1976
William R. Spencer and Howard B. Kast Dec. 1976 65 p
(Contract F33615-74-C-2007)
(AD-A040706; R77AEG194; AFAPL-TR-76-106) Avail: NTIS HC A04/MF A01 CSCL 21/5

This report documents the design, test, and development of a high temperature digital rotary position transducer. Use of magnetic sensors in this shaft encoder eliminates the need for brushes or light sources to create the eight-bit digital output signal. Included in the project were environmental testing and on-engine operation. A digital electronic readout instrument was built to aid circuit development and testing. The simple construction of the encoder makes this device well suited for aircraft engine applications. Author (GRA)

N77-31173# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
MULTISTAGE AXIAL-FLOW TURBOMACHINERY WAKE PRODUCTION, TRANSPORT, AND INTERACTION Interim Report, 1 Sep. 1975 - 30 Sep. 1976
Douglas P. Schmidt and Theodore H. Okiishi Nov. 1976 237 p refs
(Contract AF-AFOSR-2916-76)
(AD-A041108; ISU-ERI-AMES-77130; TCRL-7; AFOSR-77-0720TR) Avail: NTIS HC A11/MF A01 CSCL 13/7

The first year results of a study of multistage axial-flow turbomachine wake production, transport and interaction are described in this report. Evidence indicating how the noise level measured at the inlet of a low speed, multistage, axial-flow research compressor was found to vary appreciably with inlet guide vane and stator row relative circumferential positioning with the largest amount of noise reduction occurring at the blade passing frequency. The results of detailed slow- (cobra probe and surface pressure taps) and fast-response (hot-wire) measurements made within the research compressor flow field to aid in understanding the physics involved are shown in scalar and vector plots and tables. Significant local changes in blade-section aerodynamic performance and flow field appearance with variation in stationary blade row placement were observed although corresponding improvement of overall efficiency could not be ascertained. Several interesting periodically unsteady aspects of the flow field and its measurement are demonstrated and some conclusions about blade row interaction are proposed. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-31174*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FAILURE EFFECTS SIMULATION OF A LOW AUTHORITY FLIGHT CONTROL AUGMENTATION SYSTEM ON A UH-1H HELICOPTER
Lloyd D. Corliss and Peter D. Talbot Aug. 1977 46 p refs Prepared in cooperation with USAAMRDL, Moffett Field, Calif.
(NASA-TM-73258; A-7097) Avail: NTIS HC A03/MF A01 CSCL 01C

A two-pilot moving base simulator experiment was conducted to assess the effects of servo failures of a flight control system on the transient dynamics of a Bell UH-1H helicopter. The flight control hardware considered was part of the V/STOLAND system built with control authorities of from 20-40%. Servo hardover and oscillatory failures were simulated in each control axis. Measurements were made to determine the adequacy of the failure monitoring system time delay and the servo center and lock time constant, the pilot reaction times, and the altitude and attitude excursions of the helicopter at hover and 60 knots. Safe recoveries were made from all failures under VFR conditions. Pilot reaction times were from 0.5 to 0.75 sec. Reduction of monitor delay times below these values resulted in significantly reduced excursion envelopes. A subsequent flight test was conducted on a UH-1H helicopter with the V/STOLAND system installed. Series servo hardovers were introduced in hover and at 60 knots straight and level. Data from these tests are included for comparison. Author

N77-31175*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A MATHEMATICAL FORCE AND MOMENT MODEL OF A UH-1H HELICOPTER FOR FLIGHT DYNAMICS SIMULATIONS
Peter D. Talbot and Lloyd D. Corliss Jun. 1977 45 p refs Prepared in cooperation with USAAMRDL Moffett Field, Calif.
(NASA-TM-73254; A-7080) Avail: NTIS HC A03/MF A01 CSCL 01C

A model of a UH-1H helicopter was developed to support flight simulations and for developmental work on an avionics system known as V/STOLAND system. Equations and numerical values of constants used to represent the helicopter are presented. Responses to stop inputs of the cyclic and collective controls are shown and compared with flight test data for a UH-1H. The model coefficients were adjusted in an attempt to get a consistant match with the flight time histories at hover and 60 knots. Response matching was obtained at 60 knots, but the matching at hover was not as successful. Pilot evaluations of the model, both fixed and moving base, were made. Author

N77-31176*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VORTEX-LIFT ROLL-CONTROL DEVICE Patent Application
John E. Lamar, inventor (to NASA) Filed 21 Mar. 1977 11 p
(NASA-Case-LAR-11868-2; US-Patent-Appl-SN-779429) Avail: NTIS HC A01/MF A02 CSCL 01C

A wing is described which constitutes a roll control device for aircraft of cropped, arrow-type planform with thin leading and side edges, having a pivotable tip to alter the crop angle of the wing during flight. Increasing the crop angle causes the wing side edge to become a trailing edge thereby reducing the wing surface area which the leading edge and side edge shed vortex systems can act against. This reduction also diminishes the strength of the shed vortex system. Decreasing the crop angle causes opposite results. NASA

N77-31177# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.
INVESTIGATION OF FLIGHT DYNAMICS DURING ROLL [UNTERSUCHUNG DER FLUGDYNAMIK BEIM ROLLEN]
H. D. Finck and G. Sachs 5 Apr. 1976 58 p refs In GERMAN
(IFD-8/76) Avail: NTIS HC A04/MF A01

The dynamics of a highly maneuverable subsonic aircraft during multiple roll around the length axis were investigated with a 6 deg of freedom computer program. The nonlinear dependencies on the aerodynamic forces and moments are taken into account. The effect of the dynamic derivation of lateral motion on the overall motion is shown. The relationship between the position of the overall rotation vector and the velocity vector is represented. ESA

N77-31178# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.
RECOGNITION CRITERION AND PRODUCTION OF EASILY SOLVABLE MODELS FOR FLIGHT MECHANICAL OPTIMIZATION PROBLEMS [ERKENNUNGSKRITERIUM UND ERZEUGUNG LEICHT LOESBARER MODELLE FUER FLUGMECHANISCHE OPTIMIERUNGSPROBLEME]
Bernd Faber 12 Nov. 1976 118 p refs In GERMAN
(IFD-9/76) Avail: NTIS HC A06/MF A01

A simplification scheme is presented for obtaining easily solvable flight mechanical optimization models based on point-wise optimization, which allows attaining the least number of physical approximations. Several extensively described examples show that new optimization statements can be obtained easily by using

the scheme. The point-wise method is applicable in combination with a solution scheme. ESA

N77-31179# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.
HANDLING QUALITY CRITERIA DEVELOPMENT FOR TRANSPORT AIRCRAFT WITH FLY-BY-WIRE PRIMARY CONTROL SYSTEMS
H. A. Mooij 9 May 1977 124 p refs
(Contracts NIVR-1745; RB-RLD-1973-1.1)
(NLR-TR-74141-U) Avail: NTIS HC A06/MF A01

The introduction of fly-by-wire primary flight control systems in certain categories of future transport aircraft, makes it highly desirable to initiate further studies into handling quality criteria for future guidance in system design and airworthiness certification. The handling quality criteria for such aircraft must be based on parameters which describe the combination of the aircraft and its closed-loop flight control system. Approach flight simulation and compensatory tracking, performed on a moving base flight simulator as applied to a conceptual jet transport developed around the relaxed static stability concept, is described. The frequency of the dominant mode of the pitch attitude control system and the effectiveness of the direct-lift-control-system were the parameters varied. Results of the flight simulator experiment and a pilot-aircraft system analysis are discussed. In the literature proposed criteria (two-aircraft state variable weighted sum and the pilot-in-the-loop criteria) are evaluated against simulator results obtained in this program. Author (ESA)

N77-31180# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.
THE NEED OF STICK FORCE STABILITY FOR ATTITUDE-STABILIZED AIRCRAFT, PART 1
H. A. Mooij and M. F. C. vanGool 19 Mar. 1976 62 p refs
(Contracts NIVR-1745; RB-RLD-1975-1.1)
(NLR-TR-76125-U) Avail: NTIS HC A04/MF A01

After introductory background information on the landing approach piloting task and some arguments for expanding the knowledge of handling quality criteria for certain advanced transport designs, results are given of the flight tests related to the effect of positive stick force stability on the longitudinal controllability in the landing approach of an attitude-stabilized aircraft. Positive stick force stability reduced airspeed deviations from the reference speed and the subjective pilot effort spent on airspeed holding for the aircraft configuration investigated. Based on the results obtained, follow-up testing, using a jet transport aircraft during visual approaches, is recommended. Author (ESA)

N77-31181# Advisory Group for Aerospace Research and Development, Paris (France).
HIGHLIGHTS
Sep. 1977 26 p refs
(AGARD-Highlights-77/2) Avail: NTIS HC A03/MF A01

Challanges and trends in guidance and control and the objectives and functions of AGARD's Information Panel programs are discussed. Highlights of the National Delegates Board Meeting are included with a list of AGARD meetings for 1978. A.R.H.

N77-31076# General Dynamics/Fort Worth, Tex.
PREDICTION OF TRANSONIC AIRCRAFT BUFFET RESPONSE
Atlee M. Cunningham, Jr. and David B. Benepe, Sr. *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 21 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31079# Royal Aircraft Establishment, Bedford (England).
MEASUREMENTS OF BUFFETING ON TWO 65 DEG DELTA WINGS OF DIFFERENT MATERIALS
D. C. Mabey and G. F. Butler *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 14 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31083# Saab-Scania, Linkoping (Sweden). Aerospace Div.
FLUTTER CALCULATION FOR THE VIGGEN AIRCRAFT WITH ALLOWANCE FOR LEADING EDGE VORTEX EFFECT
In AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 7 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31084# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Dynamics Lab.
A BRIEF OVERVIEW OF TRANSONIC FLUTTER PROBLEMS
Walter J. Mykytow *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 13 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N77-31182# Systems Research Labs., Inc., Dayton, Ohio.
AIRCRAFT SIMULATOR DATA REQUIREMENTS STUDY, VOLUME 2 Final Technical Report, 1 May 1976 - 30 Jan. 1977
Harold L. Iffland and George A. Whiteside Jan. 1977 78 p
(Contract F33615-76-C-0106)
(AD-A040930; ASD-TR-77-25-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 01/3

The rising procurement and operational costs of modern air weapon systems combined with a need to conserve fuel and to extend the service life span and inventory level of high performance combat aircraft dictate a requirement to perform more and more of the training necessary to attain and maintain combat efficiency in simulators. This will not only create requirements for a greater number of simulators but more importantly, it will require a great many more full mission simulators. This document describes the methodology to fulfill the requirement for timely and accurate data. GRA

N77-31183# Air Force Flight Test Center, Edwards AFB, Calif.
AIR FORCE FLIGHT TEST CENTER TECHNOLOGY NEEDS Final Report, period ending 1976
E. Coleal May 1977 17 p
(AD-A040580; AFFTC-TR-77-14) Avail: NTIS HC A02/MF A01 CSCL 01/3

This document presents all of the 1976 technology needs of the Air Force Flight Test Center. The technology needs are: engineering anthropometric and biomechanical evaluation of aircraft crew station geometries, vector miss distance indicator, automatic scoring system for air-to-air and air-to-ground gunnery, an automatic bomb scoring system, and an airborne instrumentation system for measurement of jet engine nozzle exhaust-gas velocity. GRA

N77-31184# Naval Air Propulsion Test Center, Trenton, N.J. Dept. of Propulsion Technology and Project Engineering.
NAPTC FACILITY MODIFICATIONS REQUIRED FOR ALTITUDE TESTING OF CURRENT V/STOL ENGINE Final Report
Joseph F. Boytos and John Lezniak May 1977 42 p refs
(AD-A041608; NAPTC-PE-102) Avail: NTIS HC A03/MF A01 CSCL 21/5

Modifications were made to NAPTC altitude chamber 3E to provide the capability to test current V/STOL aircraft engines. A test program was conducted with a F402 vectored-thrust turbofan engine to evaluate the modifications and verify facility operational capability. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-31185*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems.
ADVANCED SPACE PROGRAM STUDIES. OVERALL EXECUTIVE SUMMARY
M. G. Wolfe 30 Jun. 1977 54 p ref
(Contract NASw-2884)
(NASA-CR-154893; ATR-77(7379-01)-1) Avail: NTIS HC A04/MF A01 CSCL 22A

NASA and DoD requirements and planning data were used in multidiscipline advanced planning investigations of space operations and associated elements (including man), identification of potential low cost approaches, vehicle design, cost synthesis techniques, technology forecasting and opportunities for DoD technology transfer, and the development near-, mid-, and far-term space initiatives and development plans with emphasis on domestic and military commonality. An overview of objectives and results are presented for the following studies: advanced space planning and conceptual analysis, shuttle users, technology assessment and new opportunities, standardization and program practice, integrated STS operations planning, solid spinning upper stage, and integrated planning support functions. Author

N77-31186*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, May - Jun. 1977
15 Aug. 1977 209 p
(Contract NAS7-100)
(NASA-CR-154990; JPL-PR-42-40) Avail: NTIS HC A10/MF A01 CSCL 22D

The functions and facilities of the Deep Space Network, its supporting research and technology and network operations are discussed. For individual titles, see N77-31187 through N77-31211.

N77-31187*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1977 p 1-3 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

Objectives, functions, and organization of the Deep Space Network are summarized. A deep space station, ground communication, and network operations control capabilities are described. Data system configurations for testing, training, and network operations control functions are outlined. Author

N77-31188*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM: MARK III-77 c14
W. D. Chaney *In its* The Deep Space Network 15 Aug. 1977 p 4-13 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

The Deep Space Network tracking system is described. Revisions of subsystem Mark III-75 are briefly outlined, and the currently used multimission support subsystem Mark III-77 is described. Tracking functions performed are given as well. Author

N77-31189*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT c17
R. B. Miller *In its* The Deep Space Network 15 Aug. 1977 p 14-20 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

The Deep Space Network master schedule for the Pioneer Venus 1978 mission is updated. Current support status for the mission is described. Author

N77-31190*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATUS OF THE DEEP SPACE NETWORK-VOYAGER FLIGHT PROJECT TELECOMMUNICATIONS COMPATIBILITY Summary Report c32
A. I. Bryan, R. P. Kemp, and B. D. Madsen *In its* The Deep Space Network 15 Aug. 1977 p 21-40 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

Deep Space Network-Voyager telecommunications compatibility tests are described. A series of engineering level tests to determine the flight-ground interface compatibility and performance characteristics between the two systems were utilized. A summary and status of tests conducted on Voyager spacecraft are reported. Author

N77-31191*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT Technical Report, 1 Mar. - 30 Apr. 1977 c17
T. W. Howe and D. J. Muogway *In its* The Deep Space Network 15 Aug. 1977 p 41-51 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

The period 1 March 1977 through 30 April 1977 is reported and includes Deep Space Network (DSN) Mark III data system testing. Status of the Viking DSN discrepancy reporting system as well as the status of Viking related tracking and command support were also considered. Operations support of Viking events and radio science activities were examined. Current progress on the major reconfiguration of the Network is presented in the context of support for the Viking extended mission. Author

N77-31192*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT Technical Report, 15 Apr. - 15 Jun. 1977 c17
P. S. Goodwin, E. S. Burke, and G. M. Rockwell *In its* The Deep Space Network 15 Aug. 1977 p 52-56 ref (For primary document see N77-31186 22-12)
(Rept-16) Avail: NTIS HC A10/MF A01 CSCL 17B

Activities of the Deep Space Network in support of the Helios project from 15 April through 15 June 1977 are reported. Information concerning Helios-2's superior conjunction period, Faraday rotation experimentation during solar conjunction, updated Mark III data system status, and other mission oriented activities is included. Author

N77-31193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK TO VIKING ORBITER TELECOMMUNICATION LINK EFFECTS DURING 1976 SUPERIOR CONJUNCTION c32
F. H. J. Taylor *In its* The Deep Space Network 15 Aug. 1977 p 57-70 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

Planning of the Viking superior conjunction by the Viking Project and the Deep Space Network is reviewed. Spacecraft and ground station activities and configuration during the three month superior conjunction period are presented and observations made are described. Author

N77-31194*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN WATER VAPOR RADIOMETER DEVELOPMENT: RECENT WORK Summary, 1976 - 1977 c35
S. D. Slobin and P. D. Batelaan *In its* The Deep Space Network 15 Aug. 1977 p 71-75 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

A water vapor radiometer (WVR) was developed which measures the atmospheric noise temperature at two different frequencies. These noise temperatures are used in empirical-theoretical equations which yield tropospheric range delay, in centimeters, through the atmosphere along the beam of the WVR. This range correction is then applied to measurements concerning spacecraft range and to very long baseline interferometry determinations. Author

N77-31195*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN MASER FREQUENCY STANDARDS FOR THE DEEP SPACE NETWORK c36
P. R. Dachel, S. M. Petty, R. F. Meyer, and R. L. Sydnor *In its* The Deep Space Network 15 Aug. 1977 p 76-83 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 20E

A field operable maser has been developed for use in the Deep Space Network. Maser design was based on two experimental hydrogen maser frequency standards in operation since 1970 at DSN stations. Many design changes have been

incorporated into the maser design, both in physics and electronics systems. Short and long term frequency, RF isolation of maser output lines and the lifetime of active physics components have been improved. Automatic fault detection and location, and performance and reliability of the receiver-synthesizer system have also been altered. Author

N77-31196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE APPLICATION OF DIFFERENTIAL VLBI TO PLANETARY APPROACH ORBIT DETERMINATION c13
J. K. Miller and K. H. Rourke *In its* The Deep Space Network 15 Aug. 1977 p 84-90 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 22A

The application of differential very long baseline interferometry (VLBI) to planetary approach orbit determination is described. VLBI has resulted from the development of multistation tracking techniques and measures spacecraft and nearby extragalactic radio sources. VLBI was found to be at least an order of magnitude improvement over data types currently implemented. Author

N77-31197*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAINTENANCE AND OPERATIONS COST MODEL FOR DSN SUBSYSTEMS c83
R. W. Burt and J. R. Lesh *In its* The Deep Space Network 15 Aug. 1977 p 91-96 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 05C

A procedure is described which partitions the recurring costs of the Deep Space Network (DSN) over the individual DSN subsystems. The procedure results in a table showing the maintenance, operations, sustaining engineering and supportive costs for each subsystems. Author

N77-31198*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN IMPROVED DIGITAL ALGORITHM FOR FAST AMPLITUDE APPROXIMATIONS OF QUADRATURE PAIRS c64
B. K. Levitt and G. A. Morris *In its* The Deep Space Network 15 Aug. 1977 p 07-101 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 12A

A computationally fast algorithm for approximating the amplitude (A) of a quadrature pair (I,Q) has been discovered. The piecewise linear formula, the unbiased estimate of $A=X+1/8y$ when $X > \text{or} = 3Y$ and $7/8X + 1/2Y$ when $X <$ or $= 3Y$ applies where X is congruent to the maximum absolute value of (I,Q) and Y is congruent to the minimum absolute value of (I,Q). This algorithm has been proven to be far more accurate then currently used approximations. An immediate application is the wideband digital spectrum analyzer under development for monitoring radio frequency interference at Deep Space Network stations. Author

N77-31199*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIFE-CYCLE COSTING: PRACTICAL CONSIDERATIONS c83
I. Eisenberger and G. Lorden *In its* The Deep Space Network 15 Aug. 1977 p 102-109 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 05C

The history and methodology of life-cycle costing are presented and analyzed, contrasting the potential benefits of the technique with the difficulties of its application. Examples and a short survey of the literature are given. Author

N77-31200*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications System Research Section.
CONCATENATED SHIFT REGISTERS GENERATING MAXIMALLY SPACED PHASE SHIFTS OF PN-SEQUENCES c64
W. J. Hurd and L. R. Welch (USC, Los Angeles) *In its* The Deep Space Network 15 Aug. 1977 p 110-116 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 12A

A large class of linearly concatenated shift registers is shown to generate approximately maximally spaced phase shifts of pn-sequences, for use in pseudorandom number generation. A constructive method is presented for finding members of this class, for almost all degrees for which primitive trinomials exist. The sequences which result are not normally characterized by trinomial recursions, which is desirable since trinomial sequences can have some undesirable randomness properties. Author

N77-31201*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
ON THE FUNDAMENTAL STRUCTURE OF GALOIS SWITCHING FUNCTIONS c64
B. Benjauthrit and I. S. Reed (Univ. Southern Calif., Los Angeles) *In its* The Deep Space Network 15 Aug. 1977 p 117-133 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 12A

It is shown that the fundamental structure of Galois switching functions follows naturally from that of Boolean switching functions. An expanded formula for deriving multimomial Galois switching functions is provided with illustrations of its application. Author

N77-31202*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
PHASE FLUCTUATION SPECTRA: NEW RADIO SCIENCE INFORMATION TO BECOME AVAILABLE IN THE DSN TRACKING SYSTEM MARK III-77 c32
A. L. Berman *In its* The Deep Space Network 15 Aug. 1977 p 134-140 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

An algorithm was developed for the continuous and automatic computation of Doppler noise concurrently at four sample rate intervals, evenly spanning three orders of magnitude. Average temporal Doppler phase fluctuation spectra will be routinely available in the DSN tracking system Mark III-77 and require little additional processing. The basic (noise) data will be extracted from the archival tracking data file (ATDF) of the tracking data management system. Author

N77-31203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
DSN RADIO SCIENCE SYSTEM MARK III-78 REAL-TIME DISPLAY CAPABILITY c32
A. L. Berman *In its* The Deep Space Network 15 Aug. 1977 p 141-145 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

The current plane to provide radio science real-time display capability in response to multimission radio science requirements is described. Topics discussed include the display of Doppler frequency and high-resolution graphical display of all closed-loop radio metric parameters, and spectrum displays of open-loop receiver output. Author

N77-31204*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL-FREQUENCY FEED SYSTEM FOR 26-METER ANTENNA CONVERSION c32
R. W. Hartop *In its* The Deep Space Network 15 Aug. 1977 p 146-149 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

New cassegrain feed cone assemblies were designed as part of the upgrade of three 26-meter diameter antennas to 34-meter diameter with improved performance. The new dual-frequency feed cone (SXD) will provide both S- and X-band feed systems and traveling wave masers, with a reflex reflector system to permit simultaneous operation analogous to the 64-meter antennas. Tasks involved in adding the X-band receiving capability and improving the S-band feed performance in support of Voyager and later missions described in. Author

N77-31205*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
INTERMODULATION COMPONENTS IN THE TRANSMITTER RF OUTPUT DUE TO HIGH VOLTAGE POWER SUPPLY RIPPLE c33
E. J. Finnegan *In its* The Deep Space Network 15 Aug. 1977 p 150-151 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 09C

The economic feasibility of eliminating the 400-Hz motor-generator sets used to provide power to the high-voltage power supplies of the 20-kW transmitters and replace them with a 60-Hz high-voltage power supply was investigated. The ef-

ficiency of a power supply that runs from the 60-Hz line directly would pay for itself in about seven years and could be designed so that the transmitter would meet all the incidental phase and amplitude modulation specifications. Author

N77-31206*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
MEASUREMENT OF KLYSTRON PHASE MODULATION DUE TO ac-POWERED FILAMENTS c33
E. J. Finnegan *In its* The Deep Space Network 15 Aug. 1977 p 152-153 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 09A

A technique for determining the intermodulation components in the RF spectrum of the S-band radar transmitter generated by having the klystron filaments heated by 400-Hz ac power is described. When the klystron is being operated with 400-Hz (ac) on the filament, the IPM is buried in the 400-Hz equipment interference noise. The modulation sidebands were separated and identified and found to be-67 db below the main carrier. This is well below the transmitter specifications, and operating the filaments on ac would not degrade the spectrum to where it would be detrimental to the radiated RF. Author

N77-31207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
COMPARATIVE THERMODYNAMIC PERFORMANCE OF SOME RANKINE/BRAYTON CYCLE CONFIGURATIONS FOR A LOW-TEMPERATURE ENERGY APPLICATION c44
F. L. Lansing *In its* The Deep Space Network 15 Aug. 1977 p 156-167 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 10A

Various configurations combining solar-Rankine and fuel-Brayton cycles were analyzed in order to find the arrangement which has the highest thermal efficiency and the smallest fuel share. A numerical example is given to evaluate both the thermodynamic performance and the economic feasibility of each configuration. The solar-assisted regenerative Rankine cycle was found to be leading the candidates from both points of energy utilization and fuel conservation. Author

N77-31208*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
THE 64-METER ANTENNA PEDESTAL TILT AT DSS 43, TIDBINBILLA, AUSTRALIA c32
G. Gale and A. A. Riewe *In its* The Deep Space Network 15 Aug. 1977 p 168-173 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

The present and possible future effects of pedestal tilt at the deep space tracking station are discussed. Topics include causes of the tilt, its amplitude and rate of change, and the method of measurement used. The degree of confidence in the measurements made is also examined. Author

N77-31209*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Network Operations Office.
RADIO-FREQUENCY INTERFERENCE EFFECTS OF CONTINUOUS SINEWAVE SIGNALS ON TELEMETRY DATA c17
P. W. Low *In its* The Deep Space Network 15 Aug. 1977 p 174-193 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

Continuous sinewave interference effects on telemetry data obtained at the Goldstone Deep Space Station (DSS 11) were analyzed. The continuous sinewave interference is treated as an extraneous noise. Empirical telemetry data degradation and drop-lock models were then developed based on test data and certain physical characteristics of the telemetry data processing system. These models will be used as a portion of the radio frequency interference detection tools in the first version of the Deep Space Interference Prediction software. Author

N77-31210*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Network Operations Section.
TRACKING SYSTEM PERFORMANCE TESTS IN THE MDS ERA c17
B. J. Buckles *In its* The Deep Space Network 15 Aug. 1977 p 194-199 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 22A

Tracking system performance tests as developed to support DSN Mark III Data Subsystem implementation project and prepass readiness tests are described. The system test design, the rationale chosen for implementation, and the inevitable compromises imposed by schedule constraints and reserves are discussed. Author

N77-31211*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
DSN RESEARCH AND TECHNOLOGY SUPPORT c14
E. B. Jackson *In its* The Deep Space Network 15 Aug. 1977 p 200-202 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

The ongoing activities at the Venus Station (DSS 13) and the Microwave Test Facility (MTF) discussed include: (1) equipment implementation for unattended operation at DSS 13; (2) salvaging of a 20-kW klystron, at a cost savings of several thousand dollars by the DSN High Power Transmitter Facility; (3) extensive tracking activities with the 26-m antenna including DSN Platform Parameters, Multistation Planetary Radar, Helios II Spectrum Broadening Analysis, VLBI Validation, Planetary Radio Astronomy, and Pulsar Rotation Constancy, for a total time of 219-1/4 observing hours; (4) clock synchronization transmissions from the DSS 13 master clock to the overseas 64-m antenna complexes and special implementation activities in support of PV-78; and (5) implementation of a hydrogen maser frequency standard and the pathfinder installation of a utility control system (UCS) and significant station modification and maintenance. Author

N77-31212# Committee on Science and Technology (U. S. House).
WORLD-WIDE SPACE ACTIVITIES: NATIONAL PROGRAMS OTHER THAN THE UNITED STATES AND SOVIET UNION; INTERNATIONAL PARTICIPATION IN THE US POST-APOLLO PROGRAM; INTERNATIONAL COOPERATION IN SPACE SCIENCE APPLICATIONS AND EXPLORATION; ORGANIZATION; AND IDENTIFICATION OF MAJOR POLICY ISSUES
Washington GPO 1977 636 p refs Rept. for Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., Sep. 1977 Prepared by the Library of Congr., Congressional Res. Service
(GPO-85-503) Avail: SOD

The space programs of all the nations of the world except the two major space powers are described along with the activities and programs of various international organizations involved in space exploration and utilization. Issues raised because of global participation in space are summarized and their impact on the national activities and policies of the US space program are discussed. A.R.H.

N77-31213*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR ASSEMBLING SPACE STRUCTURE Patent Application
James D. Johnston, Richard N. Tuggle, John L. Burch, and Keith N. Clark, inventors (to NASA) Filed 31 Aug. 1977 28 p
(NASA-Case-MFS-23579-1; US-Patent-Appl-SN-829316) Avail: NTIS HC A03/MF A01 CSCL 22A

An apparatus is described for constructing a space platform by continuously unrolling prepunched ribbon on sheet material after one end is attached to an involute core. The prepunched ribbon material is fed through the apparatus and is shaped into a predetermined channel-shaped configuration. Trusses are punched out of the ribbon and are bent downwardly and attached to a track which normally is a previously laid sheet of material. The size of the overall space structure may be increased by merely attaching an additional roll of sheet material to the apparatus. NASA

N77-31214*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
M551 METALS MELTING EXPERIMENT Final Report
G. Busch Jan. 1977 29 p refs
(Contract NAS8-28728)
(NASA-CR-150383; RE-536) Avail: NTIS HC A03/MF A01 CSCL 22A

Electron beam welding studies were conducted in the Skylab M551 metals melting experiment, on three different materials; namely 2219-T87 aluminum alloy, 304L stainless steel, and commercially pure tantalum (0.5 wt % columbium). Welds were made in both one gravity and zero gravity (Skylab) environments. Segments from each of the welds were investigated by microhardness, optical microscopy, scanning microscopy, and electron probe techniques. In the 2219-T87 aluminum alloy samples, macroscopic banding and the presence of an eutectic phase in the grain boundaries of the heat affected zone were observed. The stainless steel samples exhibited a sharp weld interface and macroscopic bands. The primary microstructural features found in the tantalum were the presence of either columnar grains (ground base) or equiaxed grains (Skylab). The factors contibuting to these effects are discussed and the role of reduced gravity in welding is considered. Author

N77-31215*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OFT-1 REFERENCE FLIGHT PROFILE. DEORBIT THROUGH LANDING
David Heath, Lazarus Gonzales, Moises Montez, James M. Hiott (McDonnell Douglas Tech. Service Co., Inc.), Roger Ruda (McDonnell Douglas Tech. Service Co., Inc.), and Howard Kyle (McDonnell Douglas Tech. Service Co., Inc.) Aug. 1977 160 p refs
(NASA-TM-74939; JSC-12957; Rept-77-FM-36) Avail: NTIS HC A08/MF A01 CSCL 22A

Changes made in the de-orbiting through landing reference flight profile because of increases in Orbiter weight during entry and in the circular orbital attitude prior to deorbit are discussed. The rationale for the shaping of each phase is also presented. Author

N77-31216# Los Alamos Scientific Lab., N. Mex.
COMETARY NUCLEUS RELEASE EXPERIMENTS AND ICE PHYSICS
Walter F. Huebner 1976 6 p refs Presented at Shuttle-Based Comet Expt. Meeting, Huntsville, Ala., 4-5 Nov. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2545; Conf-761148-1) Avail: NTIS HC A02/MF A01

Some physical and chemical processes involved in the evaporation and sublimation of mixtures of frozen gases are discussed. Effects of zero gravity, vacuum and solar radiation are emphasized. Relevant experiments that can be carried out with the aid of the space shuttle are proposed. The ice surface and the space just above the surface, i.e., the physics and chemistry of ice sublimation are mainly considered. Author (ERA)

N77-31217# European Space Agency, Paris (France).
PRODUCTION OF DISPERSION ALLOYS WITH ULTRASOUND UNDER ZERO GRAVITY CONDITIONS, PHASE 1
Ernst-Guenter Lierke and Wolfgang Heide Jul. 1977 114 p refs Transl. into ENGLISH of 'Untersuch. ueber Moeglichkeiten zur Herstellung von Dispersionswerkstoffen mit Ultrashall unter den Bedingungen der Schwerelosigkeit - Phase 1', Battelle-Inst., Frankfurt am Main Report BMFT-FB-W-76-22, Dec. 1976 Original report in GERMAN previously announced as N77-23140 Original GERMAN report available from ZLDI, Munich DM 27,55
(ESA-TT-395; BMFT-FB-W-76-22) Avail: NTIS HC A06/MF A01

The investigations are based on publications concerning the technological application of ultrasonic vibrations for mixing, emulsification, dispersion, and degassing of liquids (especially metal melts) at terrestrial conditions. The main effect involved - the acoustical cavitation - was extensively analyzed taking into consideration tha main parameters of metal melts for microgravity applications. The mixing system is part of the general equipment for Spacelab and will be used for emulsification of metals with miscibility gap, for mixing nonmetallic particles and whiskers in metal melts, and for nucleation of gas bubbles in metal melts prior to solidification. During the definition phase of the investigations good chances for a successful application of the mixing system became obvious. First designs are proposed for small probe mixing (1st Spacelab mission) and for continuous flow mixing of larger quantities (later missions). Detailed considerations of later hardware components (ESA), especially on material problems (cartridges, transducer material, coating), are included. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-31218# Kaman Sciences Corp., Colorado Springs, Colo.
AN EVALUATION OF BOUNDARY LAYER FORCES AND MEASUREMENT METHODS Final Report
J. C. Nickell, V. D. Peckham, and T. F. V. Meagher Oct. 1976 146 p refs
(Contract DNA001-75-C-0038)
(AD-A040947; K-76-118U(R); DNA-4202F) Avail: NTIS HC A07/MF A01 CSCL 20/4

An analysis has been performed of the effects of asymmetric hypersonic boundary layer transition on conical reentry vehicles relative to the forces and moments acting on the vehicle. The relative importance of boundary layer thickening, increased surface mass transfer, and changes in skin friction have been addressed and the effects of each of these terms on the vehicle forces and moments have been estimated. This analysis indicates that boundary layer thickening is the most significant factor occuring during boundary layer transition and may be a source of transient vehicle instability during the boundary layer transition event. GRA

N77-31219# Technische Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
MODERN METHODS IN CELESTIAL MECHANICS [MODERNE VERFAHREN DER HIMMELSMECHANIK]
Manfred Schneider 1977 30 p refs In GERMAN Presented at Wiss. Astron. Tagung, Goettingen, West Ger. 1977
(TUM-Mitt-142) Avail: NTIS HC A03/MF A01

Methods for satellite orbit determination based on celestial mechanics are discussed. Numerical and analytical methods for solution of the motion problems are outlined. The analytical methods described include method of intermediary solutions, situation method and succession approximation, and the mean value method. ESA

N77-31196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE APPLICATION OF DIFFERENTIAL VLBI TO PLANETARY APPROACH ORBIT DETERMINATION
J. K. Miller and K. H. Rourke *In its* The Deep Space Network 15 Aug. 1977 p 84-90 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-31220# Etudes-Logiciel-Systeme, Paris (France).
FEASIBILITY STUDY ON THE OPTIMIZATION OF OPERATIONAL SUPPORT REQUIRED FOR SATELLITE CONTROL, VOLUME 1 Final Report
M. D. Gastan and M. R. Tortosa-Manresa Jan. 1977 68 p 2 Vol.
(Contract ESOC-745/75-AR)
(ESA-CR(P)-956-Vol-1) Avail: NTIS HC A04/MF A01

Optimization of the operational support system for satellite control is discussed. Points considered in particular are: development of automatic functions to a high level, to avoid time loss while waiting for operator's responses; management of priorities within a multisatellite environment (queue processing); introduc-

tion of a high level language allowing operations staff the programming of their own contingency procedures. ESA

N77-31221# Etudes-Logiciel-Systeme, Paris (France).
FEASIBILITY STUDY ON THE OPTIMIZATION OF OPERATIONAL SUPPORT REQUIRED FOR SATELLITE CONTROL. VOLUME 2: ANNEXES 1 AND 2 Final Report
M. D. Gastan and M. R. Tortosa-Manresa Jan. 1977 53 p 2 Vol.
(Contract ESOC-745/75-AR)
(ESA-CR(P)-956-Vol-2) Avail: NTIS HC A04/MF A01

Aspects of optimization of the operational support system for satellite control are discussed. Comments are described upon subsystems having a lower level of importance, such as storage and retrieval of data, I/O and Files Handler, etc. An estimate is also made of the load to be supported by the system in a multisatellite environment defined by 12 satellites. It is concluded that the front-end computers will be heavily loaded by incoming telemetry data. ESA

N77-31187*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1977 p 1-3 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

N77-31188*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TRACKING SYSTEM: MARK III-77
W. D. Chaney *In its* The Deep Space Network 15 Aug. 1977 p 4-13 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

N77-31211*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network 15 Aug. 1977 p 200-202 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-31222*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY ASSESSMENT OF THE VACUUM ENVIRONMENT IN THE WAKE OF LARGE SPACE VEHICLES
W. A. Oran and R. J. Naumann Jul. 1977 34 p refs
(NASA-TM-78129) Avail: NTIS HC A03/MF A01 CSCL 22A

The vacuum environment in the wake region of presently planned large space vehicles is calculated using simplified models of the particle fluxes from the various sources. The fluxes which are calculated come directly from the ambient, are due to ambient particles backscattered from spacecraft emissions, and are due to self scattering of spacecraft emissions. Using nominal values for the surface emissions, the flux density environment behind a large unmanned craft at 550 km altitude is calculated. Calculations indicate that the flux density on a wake vacuum experiment conducted in the vicinity of the shuttle is substantially greater than that behind unmanned craft. Author

N77-31223# Air Force Academy, Colo.
GPS SPIN PHASE DYNAMICS AND SPINDOWN ANALYSIS Final Report
Roger P. Neeland Sep. 1976 28 p refs
(AD-A041023; USAFA-TR-76-20) Avail: NTIS HC A03/MF A01 CSCL 22/3

The NAVSTAR/GPS NDS-2 satellite will be spin stabilized at approximately 100 revolutions per minute during its early flight phases, but must be nearly motionless relative to its orbit and pointing at the earth during its operational lifetime. Present plans call for the despin to be accomplished in several phases, allowing the nutation damper on the satellite to remove any nutation caused during the thrusting despin phase. This study investigates several aspects of the despin operation, including probable magnitudes of error torques due to thrust misalignment. Extensive computer simulations have verified a simplified analytic model of satellite behavior which gives insight into the expected behavior of a spinning, non-symmetric body. Insight is developed into the behavior of this type body, subject to random error torques and intentional despin torques. The extremely slow spin range of 6 to 1 revolutions per minute is examined, and the consequences of stopping and starting despin thrust at an intermediate speed is found to be undesirable in a 'worst possible case' sense. Author (GRA)

N77-31224# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SATELLITE-TO-SATELLITE DATA TRANSFER AND CONTROL
David M. Snider and David B. Coomber 19 Jan. 1977 18 p refs
(Contract F19628-76-C-0002)
(AD-A041323; TN-1977-4; ESD-TR-77-25) Avail: NTIS HC A02/MF A01 CSCL 17/2

The LES-8 and -9 satellites are three-axis stabilized earth-orbit spacecraft which provide communications at UHF and K-band frequencies with the capability of simultaneously establishing and automatically maintaining a K-band (36-38 GHz) satellite-to-satellite data link. The inter-satellite data crosslink extends the earth coverage over that which a single satellite can provide and demonstrates how a global communications system might be realized without the restrictions imposed by ground relay. This report describes the operation and characteristics of the lobing antenna and pointing control, the solid state transmitters and receivers, the autotrack receiver and elastic shift register. Ground based and post-launch test results of pointing and communication systems are presented. Also, a user-oriented system is described which, among other features, allows an operator to easily establish a crosslink from the ground terminal using pointing angles calculated by a small computer from spacecraft derived earth pointing parameters. Author (GRA)

N77-31225# PRC Systems Sciences Co., Los Angeles, Calif.
SURVEY OF SATELLITE POWER STATIONS
Charles E. Bloomquist Sep. 1976 342 p refs
(Contract EX-76-C-01-2071)
(DSE/2071-1) Avail: NTIS HC A15/MF A01

The appropriate role of satellite power station research and development in ERDA's overall program is reviewed. A task group requested the support to consist of (1) consolidating the relevant documentation; (2) providing summary descriptions of the major systems and subsystems; (3) delineating the status of key technologies; (4) preparing brief summaries of the key economic and environmental issues; and (5) assisting the task group in preparation of specified documentation. Supporting efforts are also investigated. Author

N77-31226# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
DIGITAL FILTERING METHODS, WITH APPLICATIONS TO SATELLITE ATTITUDE DETERMINATION IN THE PRESENCE OF MODELLING ERRORS. PART 1: THEORY
C. R. Traas 7 May 1976 50 p refs
(Contract NIVR-1771)
(NLR-TR-76048-U) Avail: NTIS HC A03/MF A01

A number of digital filtering methods are reviewed with examples of their application. The methods include batch processing and recursive methods, not only in the classical formulations but also in square-root formulations. The latter formulations have the purpose to prevent certain numerical inconveniences. Much attention was paid to the treatment of modelling errors. An effective algorithm was proposed to detect filter divergence. The illustrations concern a number of realistic satellite attitude determination problems. Author (ESA)

N77-31227# European Space Operations Center, Darmstadt (West Germany). Spacecraft Operations Div.
GEOS EARLY ORBIT PHASE OPERATIONS
A. H. Nimmo, comp. Paris ESA 15 Jun. 1977 45 p
Avail: NTIS HC A03/MF A01

An official record is presented of the events which occurred

during the GEOS mission between lift-off on April 20, 1977 and May 12, 1977, when routine operations were declared. The Delta launch vehicle anomaly, which occurred at approximately 20 minutes after lift-off, resulted in the placing of GEOS into an anomalous orbit which endangered its safety and aborted its planned scientific mission. Actions are outlined, taken by the mission control team to establish control of the GEOS spacecraft and to place it into an orbit, which would provide a more benign environment and at the same time a useful scientific mission.
ESA

N77-31228# European Space Agency, Paris (France).
CALCULATION, DESIGN AND EXPERIMENTAL INVESTIGATIONS FOR THE CARRIER SUPPLY OF A TELEVISION BROADCASTING SATELLITE
G. Herbster and W. Weinhardt Jul. 1977 163 p refs Transl. into ENGLISH of 'Berechnung, Entwurf u. experimentelle Untersuch. fuer die Traegerversorgung eines Fernsehrundfunksatelliten', Siemens A. G., Munich Report BMFT-FB-W-76-18, Dec. 1976 Original report in GERMAN previously announced as N77-23329 Original GERMAN report available from ZLDI, Munich DM 34.45
(ESA-TT-392; BMFT-FB-W-76-18) Avail: NTIS HC A08/MF A01

The general aspects for the design of a carrier supply for the transponder of a communication satellite are discussed in detail with special emphasis on long and short term frequency stability. A basic concept for the carrier supply of the planned German television broadcasting satellite is described; it is adaptable to all applicable combinations of frequencies and channel allocations. Several hardware approaches for the realization of the different main subunits were analyzed. It is shown that the primary dc power consumption plays the most important role, as the up-converters have to be operated with relatively high power level of the local oscillators. Author (ESA)

N77-31229# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.
INCORPORATING AN INTERNAL MASS-SPRING SYSTEM INTO THE TRAJECTORY EQUATIONS FOR A SIX-DEGREE-OF-FREEDOM MISSILE
Edward B. Lacher Apr. 1977 31 p refs
(AD-A039602; ARMID-TR-77001) Avail: NTIS HC A03/MF A01 CSCL 16/2

This report describes the analysis necessary to extend the existing six-degree-of-freedom missile trajectory equations to include a missile containing an internal mass-spring system. The analysis is divided into two main parts, dealing with the internal mass-spring system alone and with the combined projectile and mass system. This work may be considered an extension of the basic trajectory analysis documented in Picatinny Arsenal Technical Report 3391, June 1966. The major result consists of an additional differential equation describing the motion of the internal mass-spring system, to be added to the basic trajectory equations. This analysis was applied to extending a six-degree-of-freedom missile trajectory computer program at Picatinny Arsenal, and a brief discussion of this is included. Author (GRA)

N77-31230# Naval Research Lab., Washington, D. C.
PERFORMANCE LIMITS OF A DUAL-ACOUSTIC-CHANNEL SURFACE-ACOUSTIC-WAVE SAW INTERFEROMETER Final Report
M. Finnley, C. Banks, and D. C. Webb 19 Apr. 1977 23 p refs
(AD-A039636; NRL-8116) Avail: NTIS HC A03/MF A01 CSCL 17/7

Design, construction, and performance of a dual-acoustic-channel interferometer, capable of placing nulls spaced every 150 kHz from 329.15 to 335 MHz, are described. The prototype device constructed exhibited a minimum null depth for 40 consecutive nulls of 33 db, with more than half the nulls being 45 dB or more. Midband insertion loss was 27 db. Second-order effects, such as spurious signals, required some design tradeoffs. Slight modifications of the prototype should enable 50 db nulls to be achieved with an insertion loss of 20 db.
Author (GRA)

N77-31231# PRC Information Sciences Co., McLean, Va.
COMPUTER MANAGED INSTRUCTION BY SATELLITE: PHASE 1, A FEASIBILITY STUDY Final Report, 1 Apr. - 31 Dec. 1976
Kenneth A. Polcyn, E. Scott Baudhuin, Henry T. Ingle, Bernard E. Keiser, and Bernard H. Rudwick Dec. 1976 285 p
(Contract MDA903-76-C-0256)
(AD-A040139; TAEG-44) Avail: NTIS HC A13/MF A01 CSCL 05/9

This study sought to understand the conditions, constraints, and parameters that could influence the design, preparation and conduct of a demonstration involving computer managed instruction by satellite, and also to consider what communications systems would be available to become operational should the demonstration results indicate this is desirable. The eight research goals were to determine: (1) the key requirements that must be met to conduct a demonstration; (2) the preferred communications system; (3) the CMI course that could be used for the demonstration; (4) the operational potential of the demonstration objectives; (5) the demonstration design options that could yield the desired results; (6) whether an economic model could be developed to conduct a cost-effective analysis; (7) the demonstration tasks and schedule for their execution; and (8) the communications systems suitable for operationalizing the concept. Research results led to the conclusion that the demonstration is feasible, and it was recommended that the design work be undertaken. GRA

N77-31232# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
DESIGN OF TERRESTRIAL-SATELLITE HYBRID COMMUNICATION NETWORKS
H. K. Thapar and B. J. Leon May 1977 67 p refs
(Contract F30602-75-C-0082)
(AD-A040991; RADC-TR-77-180) Avail: NTIS HC A04/MF A01 CSCL 17/2

In a hybrid communication system, comprising both satellite and terrestrial networks, part of the network topology is adaptable. The availabiltiy of adaptable topology and alternate routing in such networks provides the designer with considerable freedom to insure satisfactory network and point-to-point grades of service. The complexity inherent in such a design problem is discussed. A heuristic algorithm--which can be implemented on a digital computer--for designing hybrid networks with the aim of reducing all node-to-node grades of service below a prescribed value is given. Several topics of further research are presented.
Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-31233*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
STS PAYLOADS MISSION CONTROL STUDY CONTINUATION PHASE A-1. VOLUME 2-B: TASK 2. EVALUATION AND REFINEMENT OF IMPLEMENTATION GUIDELINES FOR THE SELECTED STS PAYLOAD OPERATOR CONCEPT Final Report
Aug. 1976 163 p refs
(Contract NAS9-14484)
(NASA-CR-151027; TRW-26904-H019-RO-00-Vol-2B) Avail: NTIS HC A08/MF A01 CSCL 22B

The functions of Payload Operations Control Centers (POCC) at JSC, GSFC, JPL, and non-NASA locations are analyzed to establish guidelines for standardization, and facilitate the development of a fully integrated NASA-wide system of ground facilities for all classes of payloads. Operational interfaces between the space transportation system operator and the payload operator elements are defined. The advantages and disadvantages of standardization are discussed. A.R.H.

N77-31234*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM. EULER ANGLES, QUATERNIONS, AND TRANSFORMATION MATRICES WORKING RELATIONSHIPS
D. M. Henderson (McDonnell Douglas Tech. Services Co., Inc.) Jul. 1977 42 p refs
(NASA-TM-74839; JSC-12960; Rept-77-FM-37) Avail: NTIS HC A03/MF A01 CSCL 22A

A brief mathematical development of the relationship between the Euler angles and the transformation matrix, the quaternion and the transformation matrix, and the Euler angles and the quaternion is presented. The analysis and equations presented apply directly to current space shuttle problems. The twelve three-axis Euler transformation matrices are given as functions of the Euler angles, the equations for the quaternion as a funtion of the Euler angles, and the Euler angles as a function of the transformation matrix elements. Author

N77-31235*# Boeing Aerospace Co., Seattle, Wash.
FUTURE SPACE TRANSPORTATION SYSTEMS ANALYSIS STUDY: EXECUTIVE STUDY
31 Dec. 1976 40 p
(Contract NAS9-14323)
(NASA-CR-151494; D180-20242-1) Avail: NTIS HC A03/MF A01 CSCL 22A

A study of space transportation systems is presented to determine what evolutions and developments beyond space shuttle and interim upper stage are necessary and desirable. Potential transportation requirements resulting from a range of future space mission options are defined. Mission transportation modes and system options capable of satisfying these requirements are identified. B.B.

N77-31236*# Rockwell International Corp., Downey, Calif.
ADVANCED TECHNOLOGY LABORATORY EXPERIMENT SYSTEMS DEFINITION. VOLUME 2: MISSION ANALYSIS AND PLANNING. PART 1: FLIGHT PLAN, PAYLOAD 1 Final Report
May 1977 446 p
(Contract NAS1-14116)
(NASA-CR-145172-1; SD-76-SA-0093-2-1) Avail: NTIS HC A19/MF A01 CSCL 22A

The mission defined here reflects rigorous definitions of experiment operations and related resource utilizations and includes the added realism of key trajectory events, day-night overflight, and ground target viewing opportunities. It represents the first complete mission definition encompassing all of the important factors affecting mission design and, as such, provides a framework for future operational refinements and updates that will be required in subsequent efforts for development of the final mission plan. Author

N77-31237*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THERMAL INSULATION ATTACHING MEANS Patent Application
Lubert Leger, inventor (to NASA) Filed 12 Apr. 1977 13 p
(NASA-Case-MSC-12619-2; US-Patent-Appl-SN-786913) Avail: NTIS HC A02/MF A01 CSCL 22B

An improved isolation system is provided for attaching ceramic tiles of insulating material to the surface of a structure sought to be protected against extreme temperatures of the nature expected to be encountered by the space shuttle orbiter. This system isolates the fragile ceramic tiles from thermally and mechanically induced vehicle structural strains. The insulating tiles are affixed to a felt isolation pad formed of closely arranged and randomly oriented fibers by means of a flexible adhesive and in turn the felt pad is affixed to the metallic vehicle structure by an additional layer of flexible adhesive. NASA

N77-31238*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DESCRIPTION OF A COMPUTER PROGRAM WRITTEN FOR APPROACH AND APPROACH AND LANDING TEST POST FLIGHT DATA EXTRACTION OF PROXIMITY SEPARATION AERODYNAMIC COEFFICIENTS AND AERODYNAMIC DATA BASE VERIFICATION
David J. Homan 9 Aug. 1977 57 p
(NASA-TM-74938; JSC-13048) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program written to calculate the proximity aerodynamic force and moment coefficients of the Orbiter/Shuttle Carrier Aircraft (SCA) vehicles based on flight instrumentation is described. The ground reduced aerodynamic coefficients and instrumentation errors (GRACIE) program was developed as a tool to aid in flight test verification of the Orbiter/SCA separation aerodynamic data base. The program calculates the force and moment coefficients of each vehicle in proximity to the other, using the load measurement system data, flight instrumentation data and the vehicle mass properties. The uncertainty in each coefficient is determined, based on the quoted instrumentation accuracies. A subroutine manipulates the Orbiter/747 Carrier Separation Aerodynamic Data Book to calculate a comparable set of predicted coefficients for comparison to the calculated flight test data. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-31189*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Aug. 1977 p 14-20 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31191*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING EXTENDED MISSION SUPPORT Technical Report, 1 Mar. - 30 Apr. 1977
T. W. Howe and D. J. Muogway *In its* The Deep Space Network 15 Aug. 1977 p 41-51 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31192*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT Technical Report, 15 Apr. - 15 Jun. 1977
P. S. Goodwin, E. S. Burke, and G. M. Rockwell *In its* The Deep Space Network 15 Aug. 1977 p 52-56 ref (For primary document see N77-31186 22-12)
(Rept-16) Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31209*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Network Operations Office.
RADIO-FREQUENCY INTERFERENCE EFFECTS OF CONTINUOUS SINEWAVE SIGNALS ON TELEMETRY DATA
P. W. Low *In its* The Deep Space Network 15 Aug. 1977 p 174-193 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31210*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Network Operations Section.
TRACKING SYSTEM PERFORMANCE TESTS IN THE MDS ERA
B. J. Buckles *In its* The Deep Space Network 15 Aug. 1977 p 194-199 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 22A

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

No abstracts in this category.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-31239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL FATIGUE LIFE INVESTIGATION OF CYLINDRICAL THRUST CHAMBERS

R. J. Quentmeyer Jul. 1977 21 p refs Presented at 13th Propulsion Conf., Orlando, Fla., 11-13 Jul. 1977; sponsored by AIAA and Soc. of Automotive Engineers

(NASA-TM-X-73665; E-9188) Avail: NTIS HC A02/MF A01 CSCL 21H

Twenty-two cylindrical test sections of a cylindrical rocket thrust chamber were fabricated and 21 of them were cycled to failure to explore the failure mechanisms, determine the effects of wall temperature on cyclic life, and to rank the material life characteristics for comparison with results from isothermal tests of 12 alloys at 538 C. Cylinder liners were fabricated from OFHC copper, Amzirc, and NARloy-Z. Tests were conducted at a chamber pressure of 4.14 MW/sq m using hydrogen-oxygen propellants at an oxidant-fuel ratio of 6.0, which resulted in an average throat heat flux of 54 MW/sq m. The cylinders were cooled with liquid hydrogen at an average rate of 0.91 Kg/sec. All failures were characterized by a thinning of the cooling channel wall at the centerline and eventual failure by tensile rupture. Cyclic life rankings of the materials based on temperature do not agree with published rankings based on uniaxial, isothermal strain tests. Author

N77-31240*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

MULTIPOLE GAS THRUSTER DESIGN Ph.D. Thesis

Gerald C. Isaacson Jun. 1977 117 p refs

(Grant NsG-3011)

(NASA-CR-135101) Avail: NTIS HC A06/MF A01 CSCL 21C

The development of a low field strength multipole thruster operating on both argon and xenon is described. Experimental results were obtained with a 15-cm diameter multipole thruster and are presented for a wide range of discharge-chamber configurations. Minimum discharge losses were 300-350 eV/ion for argon and 200-250 eV/ion for xenon. Ion beam flatness parameters in the plane of the accelerator grid ranged from 0.85 to 0.93 for both propellants. Thruster performance is correlated for a range of ion chamber sizes and operating conditions as well as propellant type and accelerator system open area. A 30-cm diameter ion source designed and built using the procedure and theory presented here-in is shown capable of low discharge losses and flat ion-beam profiles without optimization. This indicates that by using the low field strength multipole design, as well as general performance correlation information provided herein, it should be possible to rapidly translate initial performance specifications into easily fabricated, high performance prototypes. Author

N77-31241# Remtech, Inc., Huntsville, Ala.

AN INVESTIGATION OF FLOW AND STABILITY CHARACTERISTICS FOR A BODY OF REVOLUTION WITH FINS AND FLARE IN PRESENCE OF PLUME INDUCED SEPARATION AT MACH NUMBERS 0.7 TO 1.4

C. Wayne Dahlke Redstone Arsenal, Ala. US Army Missile Res. and Development Command. May 1977 192 p refs Prepared in cooperation with US Army Missile Res. and Development Command, Redstone Arsenal, Ala.

(Contract DAAK40-77-C-0008)

(AD-A040860; RTR-026-1; DRDMI-TD-77-11) Avail: NTIS MF A01 CSCL 20/4

The results of a wind tunnel test, simulating rocket motor exhaust jet effects on missile aerodynamic at Mach numbers of 0.7 to 1.4 are presented. A normal jet plume simulator was used to induce afterbody boundary layer separation. Flow visualization techniques including both shadowgraph and oil flow photographs were taken. The primary emphasis for this report is the force and moment measurements taken on twelve configurations including: five tail fin configurations; body alone; three forward fin configurations; body flare combination; and two combinations of forward fins/strakes with tail fins. All force and moment coefficients are presented in plotted form. One configuration is shown with ground plane interference simulation. Author (GRA)

N77-31242# Stanford Research Inst., Menlo Park, Calif. Molecular Physics Center.

MEASUREMENT OF ION-ION NEUTRALIZATION REACTION RATES BY A MERGED BEAMS TECHNIQUE Final Report, 1 Sep. 1975 - 28 Feb. 1977

James R. Peterson, Thomas M. Miller, and Ronald E. Olson 19 May 1977 27 p refs

(Contract F44620-76-C-0018; AF Proj. 9750)

(AD-A041489; SRI-MP-77-41; AFOSR-77-0714TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

The forward and reverse cross sections have been calculated for Na + Cl yields Na(+) + Cl(-) and K + Cl yields K(+) + Cl(-), in reversible chemical reactions, using quantum close-coupling techniques with matrix elements derived from pseudopotential calculations. The collision energy-dependent cross sections were Boltzmann-averaged to obtain temperature-dependent thermal reaction rate coefficients. Since the collision velocity which induces the transitions and determines the transition probabilities varies only slightly in the threshold region, and because the maximum impact parameter collision that contributes to the cross section is approximately constant, the cross sections are almost constant at collision energies just above threshold. The Calculations were performed from threshold collision energies to 5.0 electron volts. G.D.H.

N77-31243# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.

A PLASMA MODEL OF MISSILE EXHAUST PLUMES. (AXIAL AND RADIAL CONDUCTIVITY DISTRIBUTIONS FOR THE REDEYE MISSILE) Phase Report

John D. Nogard and Glenn S. Smith Apr. 1977 133 p refs

(Contract F30602-75-C-0118)

(AD-A040057; RADC-TR-77-144) Avail: NTIS HC A07/MF A01 CSCL 21/2

The effort reported on is part of a program to completely specify the susceptibility effects of the electromagnetic environment on weapon systems. Since the electromagnetic coupling into a system is dependent upon skin currents, the electrical

properties and the effects of the exhaust plume must be completely determined. This report provides a mathematical description of the chemical and electrical characteristics of a typical tactical rocket. In particular the coaxial and radial distributions of the constitutive parameters in the wake of the rocket are developed from a plasma model of the exhaust plume. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N77-31244# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
RESIDUAL STRENGTH DEGRADATION MODEL AND THEORY OF PERIODIC PROOF TESTS FOR GRAPHITE/EPOXY LAMINATES Final Report, 1 Jan. - 15 Nov. 1976
Jann N. Yang and Liu 15 Nov. 1976 57 p refs
(Contract F33615-75-C-5112)
(AD-A040077; AFML-TR-76-225) Avail: NTIS HC A04/MF A01 CSCL 11/4

A fatigue residual strength degradation model has been derived based on the assumption that the residual strength decreases monotonically. The model is verified experimentally by use of Gr/E unnotched laminates under constant amplitude fatigue. The theory of periodic proof tests and reliability prediction for composites have been established. Experimental data for specimens under periodic proof tests and fatigue loading have been generated. It is shown that the correlation between the experimental results and the theory of periodic proof tests is outstanding. Author (GRA)

N77-31245# Naval Surface Weapons Center, White Oak, Md.
THE EFFECT OF MOISTURE ON CARBON FIBER REINFORCED EPOXY COMPOSITES. 2: MECHANICAL PROPERTY CHANGES
Joseph M. Augl 3 Feb. 1977 54 p
(WR0220401)
(AD-A039903; NSWC/WOL/TR-76-149) Avail: NTIS HC A04/MF A01 CSCL 11/4

The changes in the matrix dominated flexural and short beam shear strengths of six carbon fiber composites were determined as a function of temperature and absorbed moisture. Moisture absorption led to a strength reduction between 10 and 40 percent, depending on temperature, but this reduction in strength leveled out after equilibrium was reached with the surrounding environment. It was concluded that this loss in strength is due to a reduction in resin modulus over a wide temperature range caused by the plasticizing effect of moisture on the matrix. This loss in resin modulus was reversible, and the original dry modulus-temperature-curve was regained after the absorbed moisture was removed; simultaneously the original composite dry strength was recovered. Author (GRA)

N77-31246# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
FRACTURE AND FATIGUE DIFFUSION, EXPLOSIVE, AND ROLL BONDED Al/Al AND Ti/Al LAMINATES Final Report, 17 Feb. 1976 - 17 Feb. 1977
R. D. Goolsby 13 May 1977 119 p refs
(Contract N00019-76-C-0288)
(AD-A040387; ATC-B-94400/7CR-23) Avail: NTIS HC A06/MF A01 CSCL 01/3

The fracture and fatigue crack propagation characteristics of Al/Al and Ti/Al laminates were evaluated. Seven laminate panels of approximately 12.7 mm (0.50 in.) thickness were fabricated using diffusion, explosive, and roll bonding procedures. Specific alloy systems investigated included: diffusion bonded and roll bonded 7475 Al/1100 explosive bonded and roll bonded 7075 Al/7072 Al, and diffusion bonded Ti-6Al-4VAl. A typical laminate consisted of five 2.3 mm (0.090 in.) 7475 Al primary layers interleaved with four 0.13 mm (0.005 in.) 1100 Al secondary layers. It was found that all laminates exhibited substantially higher critical fracture toughness in the crack divider orientation than corresponding baseline, monolithic plate alloys. For example, the Al/Al laminates possessed average toughness values that ranged from 33% to 56% higher than those values for monolithic 7475 Al and 7075 Al plates. The Ti-6Al-4V/6061 Al panel had a toughness 117% higher than the baseline Ti-6Al-4V plate. Crack divider fatigue crack propagation rates were found to be similar to those rates for the baseline alloy plates. Crack arrest orientation fracture and fatigue propagation tests confirmed these laminates had significant crack arrest capacity. Criteria were outlined for efficient metal/metal laminate design for achieving highly damage tolerant structural materials. Author (GRA)

N77-31247# Atlantic Research Corp., Alexandria, Va.
INVESTIGATIONS OF PG/SiC PROCESSING VARIABLES Final Report, 1 Apr. 1974 - 1 Oct. 1975
J. P. Copeland, C. W. Newquist, and R. S. Valentine 30 Mar. 1977 61 p
(Contract F33615-74-C-5098)
(AD-A041047; AFML-TR-76-123) Avail: NTIS HC A04/MF A01 CSCL 11/3

This report describes a program conducted to investigate the relationships between process conditions and Pg/SiC codeposit coating characteristics. The work was directed primarily toward the investigation of conditions other than those routinely used to coat test components for other programs. The program involved two areas of study: (1) reduced (subatmospheric) pressure codeposition and (2) gas flow characteristics in atmospheric pressure furnaces used to coat large nozzle components. The deposition study involved the conduct of a series of experimental runs in order to establish conditions which produced an acicular SiC structure in the codeposit. A final run was conducted in an attempt to apply a coating with this microstructure to a contoured surface which simulated a subscale nosecap. The flow study involved the construction and operation of a 2D water analog of large deposition furnaces. The analog was used to simulate flow patterns in furnace assemblies then in use to coat nosecaps and throat inserts for 7.0 inch nozzles. The SiC structure is dependent upon pressure, but an acicular SiC structure can be achieved at reduced pressure. Further, acceptable deposition rates can be achieved at reduced pressure. Generally, smooth coatings result and the bond with the substrate material (ATJ graphite) is strong. GRA

N77-31248# California Univ., Livermore. Lawrence Livermore Lab.
LIGHTWEIGHT COMPOSITE PRESSURE VESSELS
M. A. Hamstad, R. H. Toland, and T. T. Chiao 28 Jun. 1976 36 p refs
(Contract W-7405-eng-48)
(UCID-17176) Avail: NTIS HC A03/MF A01

Organic and graphite fiber/epoxy pressure vessels (10.2 cm dia) were fabricated. Some were lined with alternating layers of rubber and polymer and some were lined with aluminum. The vessels were subjected to permeation tests, fatigue cycling, and burst tests. Both liners performed well. Larger pressure vessels subjected to the same tests developed leakage problems in the liners. Some of the causes of the leaks are identified and recommended solutions are given. ERA

N77-31249# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF A GLASS POLYMER COMPOSITE SEWER PIPE FROM WASTE GLASS Progress Report, Jul. - Sep. 1976
L. E. Kukacka 1976 12 p refs
(Contract EY-76-C-02-0016)
(BNL-50577; PR-1) Avail: NTIS HC A02/MF A01

A program is described for developing methods for incorporating waste glass into composites which can be used for construction

materials. Progress is reported in the fabrication of a glass polymer composite sewer pipe containing glass separated from urban waste. Field testing of full scale specimens in two townships is being conducted. Other potential applications include building blocks, chemical storage tanks, and insulating panels for use in energy storage systems. ERA

N77-31250# Bendix Corp., Kansas City, Mo.
REDUCE THE COST OF ELECTRONIC PACKAGING WITH INVESTMENT CASTINGS
W. E. Cromwell Nov. 1976 11 p Presented at the IEEE Mid-Am. Electron. Conf., Overland Park, Kan., 9 Nov. 1976
(Contract EY-76-C-04-0613)
(BDX-613-1720; Conf-761128-1) Avail: NTIS HC A02/MF A01

The use of investment castings was shown to provide great flexibility in the design of electronic-component packaging while satisfying functional requirements, reducing fabrication costs, and improving product quality, appearance, and reliability. The basic investment casting process is briefly described, examples of products are shown, and guidelines for the design of investment castings are presented. ERA

N77-31251# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
NONLINEAR MULTIAXIAL MODELING OF GRAPHITIC AND CARBON-CARBON MATERIALS Final Technical Report, Mar. 1975 - Jun. 1976
Robert M. Jones Dec. 1976 197 p refs
(Contract F33615-75-C-5212)
(AD-A040074; AFML-TR-76-215) Avail: NTIS HC A09/MF A01 CSCL 11/4

The nonlinear material model due to Jones and Nelson is extended to temperature-dependent material behavior and applied to the anlaysis of the Southern Research Institute Thermal Stress Disk Test. The predicted diametral deformations of the annular disk are within three percent of the measured deformations at three times in a specific test. The Jones-Nelson model is extended to treatment of materials with first nonlinear then linear stress-strain behavior in what is called the Jones-Nelson-Morgan nonlinear material model. The JNM model is necessary for materials with strong nonlinearities as is demonstrated for ATJ-S graphite in a reentry vehicle nosetip stress analysis. The JNM model is also speculated to be useful for carbon-carbon materials because all pertinent numbers and types of nonlinearities can be treated. A linear elastic multimodulus analysis is used to demonstrate that the ASTM-Flexure Test does not lead to useful results for carbon-carbon and other multi-modulus materials. Necessary future modeling work for carbon-carbon is outlined.
Author (GRA)

N77-31252# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
RELIABILITY PREDICTION AND COST OPTIMIZATION FOR COMPOSITES INCLUDING PERIODIC PROOF TESTS IN SERVICE Interim Report, Jan. - 15 Nov. 1976
Jann N. Yang 15 Nov. 1976 86 p refs
(Contract F33615-75-C-5112)
(AD-A040076; AFML-TR-76-224) Avail: NTIS HC A05/MF A01 CSCL 11/4

An exploratory reliability analysis of composites under periodic proof tests in service is presented. The ultimate strength of composites is a random variable having a two-parameter Weibull distribution. A residual strength model is employed to describe the strength degradation of composites under service loads. Fatigue failure occurs as soon as the residual strength of composites is exceeded by service loads, such as gust turbulence for transport-type aircraft and maneuver loads for fighter aircraft. Both the gust and maneuver loads are considered as random loads and their exceedance curves obtained from field data are used in the present analysis. Meanwhile, the composites are subjected to periodic proof tests in order to eliminate weak components and to ensure an acceptable level of reliability. Taking into account all the random variables (ultimate strength and residual strength), strength degradations, service loads, proof tests and renewal processes, the probability of structural failure in service is derived. It is demonstrated by numerical examples that significant cost savings and reliability improvement for composite structures can be achieved by the application of the optimal periodic proof test. GRA

N77-31253# AiResearch Mfg. Co., Torrance, Calif.
HIGH TEMPERATURE SLOW CRACK GROWTH IN SILICON CARBIDES Annual Summary Report, 13 Oct. 1975 - 13 Oct. 1976
David E. Schwab and Harry A. Warren 30 Mar. 1977 32 p refs
(Contract N00014-76-C-0249)
(AD-A039220; AiResearch-77-13571) Avail: NTIS HC A03/MF A01 CSCL 11/2

Silicon carbide (SiC) has been selected as a material having good potential for high-temperature heat exchanger applications. At the temperatures where ceramic materials must operate in advanced engines, some strength degradation will occur. Therefore, it is important to characterize the strength properties in the elevated temperature regime to establish effective operational stress levels for heat exchanger component design. Thus, the primary objective of this program is the evaluation of safe working stresses for the application of silicon carbide material to heat exchangers. Failure of most ceramic materials with the potential for high-temperature structural application is controlled by the propagation of small preexisting flaws until fracture occurs. The primary determinant of safe working stress and service life is the nature of slow crack growth in these materials. The design of ceramic heat exchangers has been hindered due to the lack of reliable test methods for obtaining high-temperature material characteristics. Recently, however, a promising method for studying the high-temperature slow crack growth in ceramic material has been developed. This technique uses an essentially constant stress intensity specimen (the double torsion specimen) under constant displacement rate conditions. Author (GRA)

N77-31254# Rutgers Univ., New Brunswick, N. J. High Pressure Research Lab.
A HIGH-PRESSURE X-RAY STUDY OF NYLON 11
B. A. Newman, T. P. Sham, and K. D. Pae 1 May 1977 27 p refs
(Contract N00014-75-C-0540)
(AD-A039383; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07/3

An X-ray diffraction study of Nylon 11 was carried out at high pressures and high temperatures. Careful measurements made on both wet and dry samples at atmospheric pressure indicated that the structure of Nylon 11 suggested by Slichter was not quite correct. Some distortion of the planar conformation causes a shortening of the c repeat distance from the value required for a fully extended conformation. The compressibility of the crystal lattice at higher pressures up to 20kb was studied and related to the anisotropic bonding present in the structure.
Author (GRA)

N77-31255# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
COMPUTER PROGRAM (OPTCOMP) FOR OPTIMIZATION OF COMPOSITE STRUCTURES FOR MINIMUM WEIGHT DESIGN Technical Report, Jun. 1973 - Oct. 1976
N. S. Khot Feb. 1977 162 p refs
(AD-A040257; AFFDL-TR-76-149) Avail: NTIS HC A08/MF A01 CSCL 09/2

The computer program OPTCOMP can be used to optimize or analyze a composite structure. The program uses an iterative procedure based on optimality criteria to design a minimum weight structure. The response of the structure to the applied loads is obtained by finite element analysis. The design variables are modified during each iteration by using a recurrence relation. The four strength criteria included in the program are maximum stress, maximum strain, Hill's criteria modified by Tsai and Norris criteria. The plate elements can be designed to prevent local buckling. The elements can be linked to have the same sizes if desired. A mixture of composite and metal structure can be designed by suitable definition of material properties.
Author (GRA)

N77-31256# Aerospace Corp., El Segundo, Calif. Ivan A. Letting Labs.
COEFFICIENT OF FRICTION OF PTFE-IMPREGNATED

POROUS BRONZE VERSUS TEMPERATURE Interim Report
Alfred A. Fote, A. H. Wildvank, and Robert A. Slade 11 May 1977 23 p refs
(Contract F04701-76-C-0077)
(AD-A040471; TR-0077(2270-30)-5; SAMSO-TR-77-99) Avail: NTIS HC A02/MF A01 CSCL 11/4

DU (registered trademark of the Glacier Medal Company, Ltd.) is a composite material consisting of sintered bronze, impregnated primarily with polytetrafluorethylene (PTFE), mounted on a steel backing. It is used as a dry lubricant in bushings and for such components as hinges both on the ground and in space. The coefficient of friction in vacuum of DU on hard anodized aluminum coated with the DU was shown to double as the temperature was lowered from 60 to -20C. The expression mu = 1.33 exp(-0.01092T) was derived to describe this behavior. The derivation was made with the expression mu = s/p as a basis, where s = shear strength of PTFE, and p = hardness of bronze. The resulting equation or mu fits the data excellently, thereby demonstrating the validity of the adhesion theory of friction for this material. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N77-31257 Houston Univ., Tex.
FLAME INHIBITION BY ALIPHATIC HALIDES Ph.D. Thesis
Bernard H. White 1976 255 p
Avail: Univ. Microfilms Order No. 77-10111

A system is established whereby various compounds may be added for flame inhibition to a premixed methane-oxygen flame. The following parameters were monitored: (1) - OH(*), -CH(*), and C2(*) emission intensity; (2) electron density; and (3) combustion products. The additives used were CH2Cl2, CCl4, C2H5Br, CH2Br2, CH3I, and various other nonhalogenated species. The halogenated compounds exhibit the following results: (1) -CH(*) emission increases linearly; (2) C2 (*) emission increases more sharply than -CH(*) emission; (3) -OH(*) emission intensity decreases; (4) the electron density decreases at low inhibitor concentrations followed by an increase at higher inhibitor concentrations; and (5) the halogen in the various flame additives appears in the final combustion products. Dissert. Abstr.

N77-31258*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
STUDY OF EFFECTS OF INJECTOR GEOMETRY ON FUEL-AIR MIXING AND COMBUSTION Final Report
Louis H. Bangert and Robert L. Roach Aug. 1977 72 p refs
(Grant NGR-11-002-177)
(NASA-CR-154985) Avail: NTIS HC A04/MF A01 CSCL 21B

An implicit finite-difference method has been developed for computing the flow in the near field of a fuel injector as part of a broader study of the effects of fuel injector geometry on fuel-air mixing and combustion. Detailed numerical results have been obtained for cases of laminar and turbulent flow without base injection, corresponding to the supersonic base flow problem. These numerical results indicated that the method is stable and convergent, and that significant savings in computer time can be achieved, compared with explicit methods. Author

N77-31259*# Aerotherm Corp., Palo Alto, Calif.
MSXA PACKAGING Interim Report, 14 Sep. 1976 - 31 Jul. 1977
Al McLeod Jul. 1977 10 p
(Contract NASB-32210; Aerotherm Proj. 6596)
(NASA-CR-150385) Avail: NTIS HC A02/MF A01 CSCL 07D

Marshall Experimental Sprayable Ablator (MXSA) ingredients were compounded into a two part system which requires a minimum of handling by the user. Preweighed two part kits were developed which require that the user supply only the solvent. The kits consist of all of the powdery materials in Part A, and the epoxy resin (AA397) in Part B. Recent aging data on the kits indicates that they are useable for at least 6 months. The acronym MXSA has recently been replaced with MSA (Marshall sprayable ablator). Author

N77-31260*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REDUCTION OF NITRIC OXIDE EMISSIONS FROM A COMBUSTOR Patent Application
Roger A. Craig and Huw O. Pritchard, inventors (to NASA) (York Univ., Downsview, Ontario, Canada) Filed 8 Sep. 1977 118 p
(NASA-Case-ARC-10814-2; US-Patent-Appl-SN-831632) Avail: NTIS HC A06/MF A01 CSCL 21E

A turbojet combustor and method for controlling nitric oxide emissions are provided by employing successive combustion zones. After combustion of an initial portion of the fuel in a primary combustion zone, the combustion products of the primary zone are combined with the remaining portion of fuel and additional plenum air and burned in a secondary combustion zone under conditions that result in low nitric oxide emissions. A novel turbojet combustor arrangement allows stable combustion, which usually results in large emissions of nitric oxide in a primary combustion zone, to be accompanied by low nitric oxide emissions. Controlled fuel-lean combustion in a secondary combustion zone at a lower combustion temperature results in low emissions of nitric oxide. NASA

N77-31261# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
NITRIC OXIDE PRODUCTION IN LAMINAR AND TURBULENT DIFFUSION FLAMES Interim Report
Amable Linan Feb. 1977 28 p refs
(Grant AF-AFOSR-2535-73)
(AD-A039362; Scientific-4; AFOSR-77-0585TR) Avail: NTIS HC A03/MF A01 CSCL 07/2

An analysis of the production of nitric oxide in laminar and turbulent diffusion flames has been carried out taking advantage of the large activation energy of the NO producing reactions. In laminar diffusion flames the NO production takes place in a thin-high temperature region adjacent to the thin reaction zone for the main reaction. The mass of NO produced per unit flame surface and time is calculated in terms of the main characteristic of the Burke-Schumann thin flame solution. The NO production rate in turbulent diffusion flames is related to the probability density function for an inert species diffusing through the mixing region. Author (GRA)

N77-31262# Aeronutronic Ford Corp., Newport Beach, Calif.
INFRARED ABSORPTION BY CH4, H2O, AND CO2 Final Report, 1 Oct. 1975 - 17 Dec. 1976
David A. Gryvank, Darrell E. Burch, Robert L. Alt, and Dorianne K. Zgonc Dec. 1977 88 p refs
(Contract F19628-76-C-0067)
(AD-A039380; U-6275; AFGL-TR-76-0246) Avail: NTIS HC A05/MF A01 CSCL 07/4

Spectral absorption data are presented for CH4 between 1150/cm and 1400/cm, CO2 between 500/cm and 850/cm, and H2O between 333/cm and 444/cm. Also included are data on the continuum absorption by H2O between 800/cm and 1250/cm. The samples represented cover wide ranges of the amount of absorbing gas, pressure and temperature. The data are intended primarily to provide checks for the atmospheric absorption line parameters compiled by the Air Force Geophysical Laboratories. Author (GRA)

N77-31263# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
ABSORPTION AND DESORPTION RATES OF H2 AND D2 FOR LaNi5, LaC05, LaNi2C03, AND FeTi Interim Report
Christopher P. Meilleur, Michael R. Martinelli, and Stanley W. Mayer 19 Apr. 1977 19 p refs
(Contract F04701-76-C-0077)

(AD-A039518; TR-0077(2270-10)-2; SAMSO-TR-77-80) Avail: NTIS HC A02/MF A01 CSCL 07/4

Rates of H2 absorption and desorption were measured for LaNi5, LaCo5, LaNi2Co3, and FeTi in order to examine the limitations of these alloys for storing H2 in high-power Ni-H2 satellite batteries. If the H2 absorption and desorption rates are sufficient, H2 storage in the alloys could increase the energy density and decrease the volume of Ni-H2 spacecraft batteries. The rate measurements showed that the quantity of H2 absorbed or desorbed was linearly dependent on the square root of time for all four alloys. This rate law indicated that the rate-controlling step was hydrogen atom diffusion through an adherent hydride layer to the alloy surface. The activation energy for desorption from LaNi5 was 4.5 plus or minus 0.5 kcal. Even at 0.4 C, the H2 absorption and desorption rates were sufficient that batteries could be charged and dishcarged in less than 30 min. Rates for D2 were also determined and found to be lower than for H2. The use of LaCo5 and LaNi2Co5 permitted even lower pressures than those needed with LaNi5 for H2 storage in Ni-H2 satellite batteries. Author (GRA)

N77-31264# California Univ., La Jolla. Dept. of Chemistry.
ROOM-TEMPERATURE FLUORESCENCE OF SUBSTITUTED COPPER(I) BENZENETHIOLATES
G. N. Schrauzer and H. Prakash 1 Jul. 1975 13 p refs
(Contract N00014-69-A-0200-60)
(AD-A039517; TR-12) Avail: NTIS HC A02/MF A01 CSCL 07/3

The room-temperature fluorescence of copper(I) complexes of substituted benzenethiols is discussed. The fluorescence can be excited over a wide range of excitation wavelengths with no change in the position of the emission band which occurs at 590 + or - 5 nm. The maximum emission is observed at an excitation wavelength of 470 nm which corresponds to the maximum in the excitation spectrum. The observed transition is assigned as the pi^*-d type which is inverse of the lowest energy charge-transfer transition where the Cu(I) ion d-electron is excited to a pi^* orbital of the ligand. The complexes interact with pyridine to form loosely bound adducts which exhibit yellow to green fluorescence. Author (GRA)

N77-31265# IRT Corp., San Diego, Calif.
CHEMICAL REACTIONS ON SOLID SURFACES USING MOLECULAR BEAM TECHNIQUES Final Report, 1 Jan. 1972 - 31 Mar. 1977
Robert L. Palmer 30 Apr. 1977 15 p refs
(Contract N00014-72-C-0247; NR Proj. 056-527)
(AD-A040579; IRT-8005-008) Avail: NTIS HC A02/MF A01 CSCL 07/2

Thermal energy molecular beams have been used to study chemical interactions with metal surfaces. Chemisorption of simple molecules such as H2, O2, CH4, C2Hx and CO was investigated on single and polycrystalline surfaces of Pt, Ni, Co, and Ag. Kinetic parameters and reaction mechanisms were determined for model catalytic reactions including CO and C2Hx oxidation and methanation from H2/CO mixtures. Author (GRA)

N77-31266# London Univ. (England). Dept. of Chemistry.
SPECTROSCOPIC AND THERMODYNAMIC INVESTIGATIONS OF GROUP V HALIDES Final Report, 1 Jan. 1972 - 31 Dec. 1975
Arthur Finch May 1977 31 p refs
(Grant AF-AFOSR-2196-72)
(AD-A041491; AFML-TR-74-98) Avail: NTIS HC A03/MF A01 CSCL 07/2

The preparation and spectroscopic characterization of some mixed halogen and mixed halogen-cyanide compounds of phosphorous (V) are reported. Two solid-state forms of PCL5 have been investigated by differential scanning calorimetry. Solution reaction calorimetry has been used to measure the standard enthalpies of formation of the following crystalline compounds: P2Cl9Br, PCl3Br(+)BC4(-), PBr4(+)IBr2(-), PCl4(-), ICl4(-), PCl4(-)ICl2(-) and NI3NH3. Author (GRA)

N77-31267# Harry Diamond Labs., Adelphi, Md.
ENERGY SHIFT OF ALKALI EARTHS IN THE METAL SURFACES
Richard P. Leavitt and Clyde A. Morrison Jun. 1977 52 p refs
(DA Proj. 1T1-61102-AH-44)
(AD-A042062; HDL-TR-1802) Avail: NTIS HC A04/MF A01 CSCL 07/4

The theory of alkali earth atom-metal interactions is examined. The contribution to the surface potential arising from the ions can be decomposed into two terms, one a point-charge lattice term and the other dependent on the surface states of the ions comprising the lattice. These contributions to the potential are combined with Gadzuk's image formalism to obtain energy shifts of the alkali atoms K on Pt, Cs on W, and K and Cs on PrSb. Gadzuk's theory is reviewed and criticized for self-consistency.
Author (GRA)

N77-31268# Ames Lab., Iowa.
SYNTHESIS AND CHARACTERIZATION OF SOME REDUCED ZIRCONIUM HALIDES Ph.D. Thesis
R. L. Daake Feb. 1977 86 p refs
(Contract W-7405-eng-82)
(IS-T-736) Avail: NTIS HC A05/MF A01

High temperature equilibrium experiments have revealed several new zirconium subhalides as well as nonstoichiometry among the better-known trihalides. Product Characterization by standard gravimetric and electron microprobe analyses was allied with X-ray powder and singel crystal work. Batches of ZrCl and ZrBr were prepared stoichiometrically from ZrXH and thin Zr turnings. Batches of ZrCl3 and ZrBr3 were subsequently made by reacting wellground mixtures of ZrX4 with the very soft graphitic monohalides, and ZrI3 was prepared from ZrI4 and ZrI1.8, the most reduced iodide phase. New compounds in the Zr-Cl and Zr-Br systems were prepared either by isopiestic equilibration of ZrX and ZrX3 and/or via transport in a thermal gradient. A single crystal structure determination has shown the ZrCl2.5 phase to be the first Group IVBM6 cluster compound. It crystallizes in space group Ia3d with Z=16 and is isostructural with Ta6Cl15.
ERA

N77-31269# California Univ., Berkeley. Lawrence Berkeley Lab.
CHROMATOGRAPHIC DETERMINATION OF ADSORPTION AND DIFFUSION IN A BIDISPERSED POROUS SOLID
P. G. Boisvert and E. E. Petersen Sep. 1976 116 p refs
(Contract W-7405-eng-48)
(LBL-5273) Avail: NTIS HC A06/MF A01

Mass transfer within a well defined bidispersed solid structurally similar to coal, namely 5A molecular sieves, was studied. The diffusion and adsorption of nitrogen, argon, and carbon dioxide were studied using a chromatographic technique. A monodispersed pore model was used to describe the bidispersed pore system of the 5A molecular sieve. This model was an accurate representation of the 5A pore system since negligible mass transfer resistance was measured in the micropores. Much larger solid-adsorbate interactions occur with carbon dioxide than with argon or nitrogen possibly due to the higher polarizibility and linear molecuar geometry of carbon dioxide. Extrapolation of these results to coal suggests that highly polar solvents may exhibit better penetrabilty into coal due to the higher surface interactions. This should yield more efficient coal liquefaction processes by increasing the amount of internal surface area contacted by the solvent. ERA

N77-31270# California Univ., Livermore. Lawrence Livermore Lab.
CHEMICAL EQUILIBRIA RELATING THE ISOTOPIC HYDROGENS AT LOW TEMPERATURES
J. W. Puper and P. C. Sowers 1 Dec. 1976 36 p refs
(Contract W-7405-eng-48)
(UCRL-52104) Avail: NTIS HC A03/MF A01

Hydrogen fusion requires a fuel mixture of liquefied or frozen D2 and T2. The composition of this fuel mixture is described by the equilibrium constant K sub DT. The theory of isotopic exchange reactions is discussed as applied to the hydrogen isotopes. A literature survey of the values of K sub HD, K sub HT, and K sub DT found no values of K sub DT for temperatures below 25 K and no values of K sub HD and K sub HT for temperatures below 50 K. The existing data are critically evaluated, and simplified formulas for the three equilibrium constants in the temperature range 50 to 300 K are derived from them.

Harmonic approximation theory with rotational correction was used to calculate values of K sub HD, K sub HT and K sub DT in the temperature range 4.2 to 50 K. It is found that K sub DT = 2.995 exp(-10.82/T) in the temperature range 16.7 to 33.3 K to an accuracy of one percent. Tables, graphs, and equations of K sub HD, K sub HT, and K sub DT are given for the temperature range 4.2 to 50 K. ERA

N77-31271# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.

APPROACHES TO CHEMICAL CLASS ANALYSES OF FOSSIL DERIVED MATERIALS

Bruce R. Clark, C-h. Ho, and A. Russell Jones 1977 19 p refs Presented at 173d Natl. Meeting of the Am. Chem. Soc., New Orleans, 20-25 Mar. 1977 Sponsored in part by EPA

(Contract W-7405-eng-26)

(CONF-770301-5) Avail: NTIS HC A02/MF A01

Techniques used to isolate two specific classes of compounds are outlined as well as a general class separation method for coal liquids, shale oils, or crude petroleum. The specific methods aim for the isolation of an alkane or a polycyclic aromatic hydrocarbon enriched fraction. ERA

N77-31272# National Physical Lab., Teddington (England). Div. of Chemical Standards.

AN APPARATUS FOR THE IRRADIATION OF CHEMICAL SUBSTANCES AT PRESSURES UP TO 2.5 GN/sq m

R. K. Bartlett, G. ONeill, H. S. Turner, and W. F. Wall Feb. 1976 18 p refs

(NPL-Chem-46) Avail: NTIS HC A02/MF A01

An internal Sr-90 source of organic substances at temperatures up to 250 C was used for the experiments. A standard piston-cylinder unit is supplemented by equipment for the safe handling of the source and for sample preparation. Author (ESA)

N77-31273# National Physical Lab., Teddington (England). Div. of Chemical Standards.

THE PHYSICOCHEMICAL PROPERTIES OF SLAGS. PART 1: REVIEW OF THE DENSITY AND SURFACE TENSION OF CaF2-BASED SLAGS

B. J. Keene and K. C. Mills Nov. 1976 49 p refs 3 Vol.

(NPL-Chem-60-Pt-1) Avail: NTIS HC A03/MF A01

Literature values of the density and surface tension of molten CaF2-based slags are collated and evaluated. The various experimental methods are examined to determine the errors associated with these techniques. Recommended values are selected by weighting in favor of those values which are substantiated by other investigations, particularly where a different method is employed. Author (ESA)

N77-31274# National Physical Lab., Teddington (England). Div. of Chemical Standards.

THE PHYSICOCHEMICAL PROPERTIES OF SLAGS. PART 2: REVIEW OF THE SURFACE TENSION OF SOME OXIDES AND FLUORIDES

B. J. Keene Feb. 1977 37 p refs 3 Vol.

(NPL-Chem-63-Pt-2) Avail: NTIS HC A03/MF A01

A collation of experimentally derived values for the surface tension of selected oxides and fluorides is given. The data are derived from literature published in the period from 1947 to 1976. Selection of the compounds reviewed, was based upon their possible occurrence as constituents of slags and fluxes. The data for surface tension and, where given, their dependence on temperature, have been assessed. No data appear to exist for the liquid surface tension of some important slag components, i.e. CeO, MgO, P2O5. Data for some compounds are sparse and should be treated with caution, e.g. BeF2, Cr2O3, MnO, SiO2. Author (ESA)

N77-31275# National Physical Lab., Teddington (England). Div. of Chemical Standards.

THE PHYSICOCHEMICAL PROPERTIES OF SLAGS. PART 3: REVIEW OF VISCOSITIES OF CaF2-BASED SLAGS

K. C. Mills Feb. 1977 26 p refs 3 Vol.

(NPL-Chem-65-Pt-3) Avail: NTIS HC A03/MF A01

The viscosity data for CaF2 + metal oxides slags are collated and assessed in order to assist to the selection of the optimum slag compositions for particular ESR operations. The discrepancies between the data reported by various investigators are large. Further work is recommended to allow reliable evaluations of the data to be made. Author (ESA)

N77-31276# Frankford Arsenal, Philadelphia, Pa.

DETERMINATION OF RUBIDIUM SALT ON COPPER-COATED STEEL WELDING BY USE OF ATOMIC ABSORPTION

George Norwitz, Martin E. Everett, and Herman Gordon Jul. 1976 12 p refs

(AD-A040007; FA-TT-76036) Avail: NTIS HC A02/MF A01 CSCL 07/4

Rubidium salt on copper-coated steel welding wire used in arch welding is determined by atomic absorption. Six-inch pieces of the wire are treated with 2 ml of potassium chloride solution (0.75%) and 10 ml of water, the solution is boiled down to 3-5 ml, the volume is brought up to 10 ml in a volumetric flask, and atomic absorption measurements are made at 780.0 nm using an air-acetylene flame. The potassium chloride is necessary to reduce the ionization of rubidium; without the potassium chloride, much lower absorption readings were obtained for the rubidium. It is shown the coating of rubidium carbonate produced on copper-coated steel welding wire by passing the wire horizontally through a wick saturated with rubidium carbonate solution (10%) and then through an annular compressed felt squeegie is quite variable. The results obtained ranged from a low of 0.044 to a high of 0.168 mg of rubidium carbonate per linear ft. Author (GRA)

N77-31277# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

THE VISCOSITY AND STRUCTURAL RELAXATION RATE OF EVAPORATED AMORPHOUS SELENIUM

R. B. Stephens May 1977 35 p refs

(Contract N00014-77-C-0002)

(AD-A039858; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

For this study, thin film Se samples were vacuum deposited in order to produce a molecular structure significantly different from those of the previously studied melt-quenched samples. The structure differences should have been reflected in changes in their macroscopic properties. Consideration was given to the shear and volume viscosity, and heat capacity of configurationally equilibrated systems. No observable differences from melt-quenched samples were found. This was an indication that the selenium achieves configurational equilibrium rapidly even at relatively low temperatures and it was possible to measure the equilibration rate. Non-equilibrium samples were produced which have a much lower Tg (i.e., viscosity) than melt-quenched or annealed samples. The far infrared spectrum of these samples before and after equilibration found no significant changes. Their Tg was too low to permit the handling necessary for a creep experiment. Viscosity data extended the previous data of Cukierman and Uhlmann, and Jenckel to lower temperatures. In contrast to the higher temperature WLF type behavior, it was found that the data show Arrhenius behavior between 25 and 35 C; the slope is 130 kcal/mole. This low temperature Arrhenius-high temperature WLF behavior is similar to that observed by Macedo for B2O3. These measurements were used to determine stress and thermal relaxation rates as a function of temperature. They are not directly proportional to the equilibrium viscosity; the coefficient changes by a factor of 7 over the range 25 to 36 C. The relaxation to equilibrium is not a simple exponential decay. GRA

N77-31278# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.

EXOTHERMIC CYCLE PEROXIDE REACTIONS. DECOMPOSITION OF A 1, 2, 4-TRIOXANE

Gary B. Schuster and Lynn A. Bryant 23 May 1977 7 p

(Contract N00014-76-C-0745)

(AD-A040098) Avail: NTIS HC A02/MF A01 CSCL 07/3

Thermolysis of trioxane trans 4-4-dimethyl-2-3-5-trioxabicyclo-4-4-0-decane in degassed octane solution resulted in the formation of acetone and adipaldehyde. The reaction was shown to be unimolecular with a free energy of activation of 39 kcal/mole. Although chemiluminescence from this

decomposition is possible on energetic grounds, none was detected. Author (GRA)

N77-31279# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Progress Report, Jul.-Oct. 1976
P. J. Reucroft, C. P. Madhusudhan, and G. B. Freeman Feb. 1977 25 p refs
(Contract DAAA15-74-C-0163)
(AD-A039595; EC-CR-77020; QPR-10) Avail: NTIS HC A02/MF A01 CSCL 07/4

In the period reported, equilibrium adsorption isotherms have been measured for carbon tetrachloride on superactivated carbons 1 and 2 and water vapor on BPL activated carbon and ASC whetlerite carbon. Physical adsorption accounts for the obtained results and chemisorption effects were absent. W(0) values for superactivated carbons 1 and 2 were 0.82 cc/gm and 0.66 cc/gm, respectively. Author (GRA)

N77-31280# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Progress Report, 9 Oct. 1976 - 8 Jan. 1977
P. J. Reucroft and G. B. Freeman Apr. 1977 22 p
(Contract DAAA15-74-C-0163)
(AD-A039389; ARCSL-CR-77004) Avail: NTIS HC A02/MF A01 CSCL 07/4

In the period, equilibrium adsorption isotherms have been measured for H2O vapor on BPL activated and ASC whetlerite impregnated carbons. Work was also initated on adsorption of binary mixed vapors by the carbons. It was found that HCN adsorption by BPL carbon in equilibrium with water vapor at a relative pressure of 0.8 produced a total adsorption of H2O and HCN which was greater than the adsorption of any previously measured single adsorbate. However, when the same carbon, a new BPL carbon sample or an ASC carbon sample was exposed to the same mixture, much smaller adsorption was noted. Author (GRA)

N77-31281# Naval Research Lab., Washington, D. C.
ESTIMATION OF RELATIVE ESTERIFICATION RATES BY GAS CHROMATOGRAPHY AS AN AID IN THE IDENTIFICATION OF FATTY ACIDS Memorandum Report
Paul J. Sniegoski Apr. 1977 10 p refs
(AD-A039845; NRL-MR-3489) Avail: NTIS HC A02/MF A01 CSCL 07/3

A simple and convenient method is described for estimating the relative esterification rates of unknown fatty acids, HCl catalyzed in methanol. All that is essential is a reasonably quantitative chromatographic procedure for resolving a set of acids and their methyl esters. Satisfactory estimates are obtained from acids with relative rates greater than 0.001 where the relative rate of a normal acid is 1.00. With a slight modification, relative rates of slower reacting acids can be adequately determined. Author (GRA)

N77-31282# University Coll., Cork (Ireland). Dept. of Chemistry.
ENERGY MIGRATION INVOLVING IRRADIATED SOLIDS Final Report, 1 May - 31 Oct. 1976
Joseph Cunningham and D. J. Morrisey 28 Feb. 1977 44 p refs
(Grant AF-AFOSR-2986-76)
(AD-A039803; EOARD-TR-77-0423) Avail: NTIS HC A03/MF A01 CSCL 07/4

Results are presented which point to suface sites involving O- ions and/or hydroxyls as important locations for transfer of energy via radiationless process between uv-illuminated metal oxides and probe molecules adsorbed on their surfaces. Attempted passivation of the surfaces by treatment with water vapor enhanced rather than decreased, the extent of interaction between irradiated solid and various probe molecules, including nitrous oxide or methyl halides as electron-accepting probe molecules or C2D5OD as an electron donating probe molecule. Author (GRA)

N77-31283# Stanford Research Inst., Menlo Park, Calif.
THERMOCHEMISTRY OF GASEOUS COMPOUNDS OF METALS Annual Summary Report, 5 Dec. 1974 - 4 Dec. 1975
D. L. Hildenbrand Feb. 1976 13 p refs
(Contract F44620-73-C-0037)
(AD-A040222; AFOSR-76-0383-TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Thermochemical studies of gaseous IIA monohalides CaBr, SrBr, BaBr, and BaCl were carried out by high temperature mass spectrometry. The monohalides were generated by the reaction of HBr or HCl with appropriate metal oxides in molydbenum effusion cells. Dissociation energies and standard heats of formation were evaluated from various equilibrium measurements at temperatures of 1800 to 2000 K. Preliminary thermochemical data were obtained for gaseous BaI. In the course of the work, the gaseous oxybromide OBBr was also observed, and thermochemical data were derived. From studies of the vaporization of CaBr2, SrBr2, and BaBr2 by the torsion-effusion methods, values were derived for the heats of sublimation/vaporization, heats of formation, and dissociation energies of the gaseous dibromides. The derived dissociation energies of the monohalides are compared with values obtained from flame equilibria, chemiluminescence, ionic model calculations, and Birge-Sponer extrapolations; the results provide an interesting comparison of the experimental methods, and give further information about chemical bonding in the monohalides. Author (GRA)

N77-31284# RAND Corp., Santa Monica, Calif.
MOLECULAR AND METALLIC HYDROGEN Interim Report
Marvin Ross and Charles Shishkevish May 1977 133 p refs
(ARPA Order 189)
(AD-A040578; R-2056-ARPA) Avail: NTIS HC A07/MF A01 CSCL 07/4

This report presents a comprehensive review and analysis of the published data on metallic hydrogen and a summary of the properties of molecular hydrogen that are required to determine the molecular-to-metallic hydrogen transition pressure. The best available effective interaction potential is utilized in calculating the equation of state for solid molecular hydrogen. The equation of state of metallic hydrogen is determined by four different methods and the possible range of molecular-to-metallic hydrogen is largely responsible for the wide discrepancy in calculations of the transition pressure. Metastability of metallic hydrogen is discussed and the experimental high-pressure research pertinent to the determination of molecular-to-metallic hydrogen transition pressure is reviewed. GRA

N77-31285# North Carolina Univ., Chapel Hill.
PHOTOCHEMISTRY OF NITROGEN HETEROCYLES AND THEIR METAL COMPLEXES Final Report, 1 Jun. 1969 - 1 Feb. 1977
David G. Whitten 1977 9 p refs
(Grants DAAG29-76-G-0079; DA-ARO(D)-31-124-G-1097)
(AD-A040529; ARO-8168.17-C) Avail: NTIS HC A02/MF A01 CSCL 07/5

In the early phases of this study, investigations were made of the photochemistry of nitrogen heteroaromatic compounds, particularly molecules related to pyridine, quiniline, and acridine. Work with these compounds involved a variety of different types of studies but basically the main thrust was in identifying the photochemically reactive excited states and determining the relative importance of these states. The studies were extended to the quaternary salts of these complexes in which the presence of one or more positive charges gives rise to new reactivity not observed with the free bases. Author (GRA)

N77-31286# Missouri Univ., Columbia. Dept. of Chemistry.
CHELATING AGENT ANALYSIS BY HIGH SPEED LIQUID CHROMATOGRAPHY Ph.D. Thesis
David Reese Jones, IV Jul. 1976 184 p refs
(Contract DI-14-31-0001-4099; Grant NSF MPS-75-03330)
(PB-267918/1; W77-08286; OWRT-B-095-MO(5)) Avail: NTIS HC A09/MF A01 CSCL 13B

Methods of analysis are described for chelating agents, based primarily on the separation of copper chelates by high speed liquid chromatography followed by monitoring of the copper-containing effluents by atomic absorption spectrophotometry. Details of the interface between the high speed liquid chromatograph and the atomic absorption spectrophotometer are described.

Operating parameters for the chromatograph to make it compatible with atomic absorption are detailed. Separation and analysis conditions are given. The technique as applied to sewage effluents is discussed. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-31287# National Bureau of Standards, Washington, D. C.
STRESS CORROSION CRACKING CONTROL MEASURES Final Report
B. Floyd Brown (American Univ., Washington, D.C.) Jun. 1977 83 p refs
(Contract N00014-68-A-0245-0007; ARPA Order 2616)
(NBS-Mono-156; LC-76-608306) Avail: NTIS MF A01; SOD HC $4.50 as C13.44:156

An attempt was made to diminish the incidence of stress corrosion failures by assembling the available practical measures to avoid or minimize the problem. The alloys covered are copper, aluminum, titanium and nickel alloys and high strength and stainless steels. Author

N77-31288*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF HEATING METHOD ON STRESS-RUPTURE LIFE
Peter T. Bizon and Frederick D. Calfo Jul. 1977 28 p refs
(NASA-TM-73738; E-9208) Avail: NTIS HC A03/MF A02 CSCL 11F

The effect of radiant(furnace), resistance(electric current), burner(hot gas stream), and a combination of resistance and burner heating on intermediate time (100 to 300 hr) stress-rupture life and reduction of area was evaluated. All heating methods were studied using the nickel-based alloy Udimet 700 while all but burner heating were evaluated with the cobalt-based alloy Mar-M 509. Limited test results of eight other superalloys were also included in this study. Resistance heated specimens had about 20 to 30 percent of the stress-rupture life of radiant heated specimens. The limited burner heating data showed about a 50 percent life reduction as compared to the radiant heated tests. A metallurgical examination gave no explanation for these reductions. Author

N77-31289# Oregon Graduate Center for Study and Research, Portland.
MECHANISM OF ENHANCED TOUGHNESS IN MARTENSITIC ALLOYS Final Report, 1 Oct. 1975 - 30 Sep. 1976
W. E. Wood 20 Apr. 1977 80 p refs
(Contract N00019-76-C-0149)
(AD-A040373) Avail: NTIS HC A05/MF A01 CSCL 11/6

The objective of this program was to establish the role of heat treatment parameters on the fracture toughness of ultrahigh strength alloys. Microstructural examination and plane strain fracture toughness tests were conducted on alloys 4340 and silicon modified 4340. Heat treatments included both direct as well as step quench schedules. Solutioning temperatures ranged from 870 to 1200 C, and step quenching temperatures ranged from 300 C to 1100 C. Holding times at these temperatures varied from 10 seconds to 2 hours. Tempering temperatures ranged from the as quenched condition to 350C. Valid plane strain fracture toughness results of over 90,000 psi were achieved for alloy 4340 and values of 85,000 psi were achieved for silicon modified 4340 at ultimate strength levels of over 300,000 psi for both alloys. This report covers the first year's results of the two year program. Author (GRA)

N77-31290# Stanford Research Inst., Menlo Park, Calif.
FRACTURE TOUGHNESS OF CVD ZnS
D. A. Shockey, D. J. Rowcliffe, and K. C. Dao Mar. 1977 11 p refs
(Contract N00014-76-C-0657; SRI Proj. 4928)
(AD-A040510) Avail: NTIS HC A02/MF A01 CSCL 11/6

As part of a research program to define the material properties governing the impact erosion resistance of ir windows and radomes, we have measured the plane strain fracture toughness K sub Ic of chemical vapor deposited zinc sulfide by a precise method, a modified expanded ring technique. This topical report describes the procedures and results. Author (GRA)

N77-31291# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
ALUMINIDE COATING OF IRON
Richard W. Heckel, C. Ouchi, M. Yamada, and Anthony J. Hickl May 1977 17 p refs
(Contract N00014-76-C-0198)
(AD-A040316; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

The kinetics of phase layer growth during the aluminization of Fe and during subsequent heat treatment (homogenization) were investigated. Pack Processing was employed for aluminization; the variables studied were temperature, time, amount of Al powder in the pack, and the Al powder particle size. Homogenization was studied as a function of temperature, time and extent of prior aluminization treatment. A predictive model was developed to describe the changes in coating microstructure as a function of processing parameters. Author (GRA)

N77-31292# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
STUDIES RELEVANT TO THE REACTIONS OF GASEOUS IMPURITIES WITH CIRCUIT MATERIALS IN HELIUM COOLED REACTORS
J. R. Warburton, J. E. Antill, and K. A. Peakall Aug. 1976 37 p refs revised
(AERE-R-7386-Rev; ISBN-0-70-580187-X) Avail: NTIS (US sales only) HC A03/MF A01; HMSO £1.50; PHI

The reactions of water vapor, carbon monoxide and methane with a range of iron and nickel base alloys have been studied. The majority of the work was concerned with highly alloyed materials. Their behavior in complex environments was generally dominated by oxidation by the water vapor. In the complete absence of water vapor the extent of reaction with carbon monoxide was almost independent of carbon monoxide pressure. Carburization by methane was approximately proportional to methane pressure and time of exposure. The presence of water vapor and of oxide films generally inhibited carburization by both carbon monoxide and methane. Complex behavior was observed in crevices in environments containing carbon monoxide or methane. It is attributed in part to the influence of water vapor. ERA

N77-31293# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
SERRATION AND DISSOCIATION OF EDGE DISLOCATIONS IN LOW ANGLE TILT BOUNDARIES IN GOLD
T. P. Darby and R. W. Balluffi Dec. 1976 24 p refs
(Contract E(11-1)-2679)
(COO-2679-6) Avail: NTIS HC A02/MF A01

The fine structure of low angle tilt boundaries in gold was studied by high resolution transmission electron microscopy and electron diffusion in thin-film bicrystal specimens. The boundaries were found to consist of arrays of dislocations running on average along the tilt axis, as expected. However, in the general case where the tilt axis did not lie in a [111] plane the dislocations were serrated into a 'hill and valley' structure which allowed them to dissociate on [111] into partial dislocations and patches of stacking faults. This configuration produced an electronic core energy at the expense of increased line length energy and is expected to be a general feature of dislocation in low angle tilt boundaries in metals with low (and moderately low) stacking fault energies. The importance of this phenomenon in the interpretation of pipe diffusion along dislocations in low angle tilt boundaries was discussed. Author

N77-31294# Cornell Univ., Ithaca, N.Y.
DEFECTS IN METAL CRYSTALS Progress Report, 1 May 1976 - 30 Apr. 1977
David N. Seidman Feb. 1977 84 p refs
(Contract EY-76-S-02-3158)
(COO-3158-58) Avail: NTIS HC A05/MF A01

Point defects (vacancies, self-interstitial atoms, and solute atoms), aggregates of point defects, and their interactions with

one another were studied. A strong emphasis was placed on the use of irradiating species to introduce both vacancies and interstitials in a number of pure metals. Topics discussed include: (1) transmission sputtering of gold; (2) atom-probe field-ion microscope studies; (3) point defect structure of depleted zones; (4) recovery of stage 2 of ion irradiated Pt(Au)alloys; (5) the range of a focused collision replacement sequence of ordered alloys; and (6) the fast neutron irradiation of wire specimens in EBR-2. Author

N77-31295# Sandia Labs., Albuquerque, N. Mex.
BLISTER FORMATION IN MULTIPLE ENERGY He(+) IMPLANTED STAINLESS STEEL
K. L. Wilson, L. G. Haggmark, and R. A. Langley 1976 19 p refs Presented at the Intern. Symp. on Plasma Wall Interaction, Julich, West Germany 18 Oct. 1976
(Contract E(29-1)-789)
(SAND-76-5844; Conf-761049-7) Avail: NTIS HC A02/MF A01

A series of multiple energy He(+) implantations were conducted on type 316 stainless steel at 575 and 775 K. Preimplantations with 3, 10 and 15 keV He(+) were used to create a series of uniform helium concentrations to a depth of approximately 700 A. The effects of these preimplantation helium concentrations on subsequent 20 keV bombardment were studied by gas re-emission and scanning electron microscopy. It was found that serious blistering and exfoliation would occur unless the preimplantation helium concentration was approximately greater than 0.3 atom fraction from the surface to nearly the depth of the 20 keV implant. At this preimplant level, an interconnected pathway to the surface developed, allowing helium release without surface blistering. Evidence for rapid helium mobility along the interconnection was found at temperatures as low as 80 K. These results indicate that multiple energy implantation still produces extensive surface deformation if the helium accumulates to a local critical concentration before an interconnected pathway develops. Until detailed first wall particle fluxes are available, He(+) induced surface exfoliation cannot be ruled out as a potentially serious source of wall erosion and plasma contamination in a reactor. ERA

N77-31296# Rensselaer Polytechnic Inst., Troy, N. Y. Cogswell Lab.
EUTECTIC DATA: SAFETY, HAZARDS, CORROSION, MELTING POINTS, COMPOSITIONS AND BIBLIOGRAPHY
G. J. Janz, C. B. Allen, J. R. Downey, Jr., and R. P. T. Tomkins Jul. 1976 740 p refs
(Contract PO-WA-4280)
(TID-27163-P1) Avail: NTIS HC A99/MF A01

A compenium is presented of properties relative to safety, hazards, corrosion, melting points, and compositions of molten salt eutectic mixtures. The scope of the single salts data in this compilation compasses the end-components of the eutetic mixtures reported. Each section contains a systems index and bibliography. The bibliographies in Pt. 1 and Pt. 2 total approximately 4,000 entries. More than 6,000 eutetic entries are included in the two parts. ERA

N77-31297# Utah Univ., Salt Lake City. Lab. of Environmental Radioactivity.
COMPARATIVE LEVELS OF ENVIRONMENTAL RADIOACTIVITY IN UTAH FROM INDUSTRY AND FALL OUT. A REPORT OF RADIOECOLOGICAL INVESTIGATIONS OF AIRBORNE RADIACTIVITY IN THE UTAH ENVIRONMENT Progress Report, 1 Jul. 1972 - 30 Jun. 1973
1973 194 p refs
(Contract E(26-1)-0462)
(UERL-2) Avail: NTIS HC A09/MF A01

Radioactivity in air, vegetation, soil, and wild animals in Utah was determined, and results are presented. Methods for continuous measurement of the daughter products of radon and thoron were developed and used for calculations of the integrated dose to the lungs of humans. ERA

N77-31298# Sandia Labs., Albuquerque, N. Mex.
PULSED POWER ION ACCELERATORS FOR INERTIALLY CONFINED FUSION
C. L. Olson 1976 42 p Presented at School on Plasma Phys. and CTF, Tbilissi, GA, USSR, 29 Sep. 1976
(Contract E(29-1)-789)
(SAND-76-6005; Conf-760983-2) Avail: NTIS HC A03/MF A01

Current research is described on pulsed power ion accelerators for inertial fusion, i.e., ion diodes and collective accelerators. Particle beam energy and power requirements for fusion and basic deposition characteristics of charged particle beams are discussed. Ion diodes and collective accelerators for fusion are compared with existing conventional accelerators. ERA

N77-31299# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
HEAT TREATMENT STUDIES OF ALUMINIUM ALLOY TYPE 7050 FORGINGS. THE EFFECT OF HEAT TREATMENT ON A VARIETY OF ENGINEERING PROPERTIES Interim Report
L. Schra and H. P. vanLeeuwen 19 Jan. 1976 130 p refs
(Contract NIVR-1743)
(NLR-TR-76008-U; IR-2) Avail: NTIS HC A07/MF A01

The effect of variety of heat treatments on various engineering properties was studied with the aim to derive an optimum heat treatment. The engineering properties comprised Vickers hardness, short-time tensile strength, fatigue crack propagation resistance, fracture toughness and stress corrosion resistance. The test results were compared with those obtained in earlier investigations on the older forging alloys of American and British origin 7079 and DTD 5024 and on the newly developed German forging alloy AZ74.61. The performance of the alloy 7050 proved to be generally superior to that of AZ74.61 and far superior to that of 7079 and DTD 5024. However it was found that quenching in boiling water leads to relatively inferior fracture toughness and stress corrosion properties, while in the SCC resistant condition the alloy proved to be very susceptible to general corrosive attack if exposed to an aggressive environment. Author (ESA)

N77-31300# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
STUDY OF THE GROWTH OF STRESS CORROSION CRACKS IN THE ALUMINIUM ALLOYS 7075. PART 3: CONTINUATION OF THE INVESTIGATION ON THE INFLUENCE AND THE ROLE OF THE CORROSION POTENTIAL AND THE HALIDE ANION
A. Hartman 12 Apr. 1976 107 p refs
(Contract NIVR-1741)
(NLR-TR-76042-U) Avail: NTIS HC A06/MF A01

SEN specimens of 7075 alloy loaded in bending were used to determine time to failure and the crack propagation rate as a function of K, the stress intensity factor, and of the electrical potential in 3 wt % aqueous solutions of NaCl, NaBr, and NaI with ph values of 3 and 7. The stress corrosion tests were supplemented by potentio-kinetic polarization tests in the same solutions on samples of the alloys 1050, 2024, and 7075. The results of the stress corrosion tests indicated that in the potential region between the pitting potential of the alloy in the solution and about -1.2 Volt SCE the logarithm of the region 2 crack propagation rate was a linear function of the potential. The crack rate did not decrease further at more negative potentials. The pronounced difference in shape of the stress corrosion crack front at failure of the sample at different potentials (concave, resembling the shape of the crack tip plastic zone at potentials near to the pitting potential, convex resembling the shape of the crack tip stress triaxiality domain for a straight crack front at the low potential of -1.2 V SCE) indicates that crack extension in SCC of 7075 alloy occurs as a result of both an anodic dissolution process at the plastic zone of the crack tip and a cathodic process, hydrogen generation and reduction of the fracture stress of the alloy at the crack tip. A model for stress corrosion cracking in Al-alloys is discussed. Author (ESA)

N77-31301# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A STRAIN MODIFIED STEADY-STATE CREEP RELATIONSHIP FOR HIGH STRENGTH ALUMINIUM ALLOY
J. N. Webb London Aeron. Res. Council 1977 65 p refs Supersedes RAE-TR-76085; ARC-36951
(ARC-CP-1367; RAE-TR-76085; ARC-36951) Avail: NTIS HC A04/MF A01; HMSO £3; PHI

The concept that creep response is the result of a transient approach to a minimum strain rate continuously modified by accumulating damage was investigated using high precision creep data. It was considered that the accumulated creep strain might be some measure of internal damage and curves of log creep strain rate against creep strain are shown to exhibit linearity at higher strain levels consistent with these assumptions. A modified 'steady-state' relationship was derived and the variation of its two coefficients with stress and temperature explored. The effect of load and temperature history is illustrated by varying the prior heating time, by cycling load testing and by step reductions in load level, and it is tentatively concluded that tests of these types may be correlated with the appropriate continuous creep test by using the modified 'steady-state' relationship with corrections for differences in accumulated creep strain and time at temperature. Author (ESA)

N77-31302# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

FATIGUE TESTING WITH PERIODIC HEATING: AN INVESTIGATION OF SOME METHODS OF ACCELERATION

A. K. Redfern (Hawker Siddeley Aviation Ltd., Woodford, Engl.) and F. E. Kiddle London Aeron. Res. Council 1977 43 p refs Presented at the SEE Intern. Conf. on Fatigue Testing and Design, London, 5-9 Apr. 1976 Supersedes RAE-TR-76082; ARC-36937

(ARC-CP-1368; RAE-TR-76082; ARC-36937) Avail: NTIS HC A03/MF A01; HMSO £2.50; PHI

Tests were conducted on aluminum alloy notched and riveted joint specimens under flight-by-flight loading sequences to examine the effects of varying the number of applications of heat and the maximum temperature. The effect of these parameters on fatigue life, and the underlying mechanisms are discussed. It is shown that changes in the number of applications of heat and in the maximum temperature cause appreciable changes in performance. An observation of general significance was that fatigue lives were affected by the inclusion of periods of load dwell in tests at a constant temperature of 40 C. A description is given of the multichannel testing facility used for this work. Author (ESA)

N77-31303# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

FATIGUE BEHAVIOR OF BOLTED JOINTS IN RR58 ALUMINIUM ALLOY WITH AND WITHOUT INTERFAY SEALANT

F. E. Kiddle London Aeron. Res. Council 1977 18 p refs Supersedes RAE-TR-76006; ARC-36726

(ARC-CP-1369; RAE-TR-76006; ARC-36726) Avail: NTIS HC A02/MF A01; HMSO £1.50; PHI

Simple bolted joint specimens in DTD 5014 (RR58) aluminum alloy were tested in fluctuating tension of constant amplitude. The effect of introducing a flexible sealant between the faces of the joint was significant: at high alternating stress levels life was decreased, while at low alternating stress levels life was increased. Author (ESA)

N77-31304# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

INFLUENCE OF PRIOR HEAT AND CREEP ON FATIGUE IN STRUCTURAL ELEMENTS OF DTD 5014 (RR58) ALUMINIUM ALLOY

F. E. Kiddle London Aeron. Res. Council 1977 62 p refs Supersedes RAE-TR-76094; ARC-37042

(ARC-CP-1375; RAE-TR-76094; ARC-37042) Avail: NTIS HC A04/MF A01; HMSO £3; PHI

Effects of heat on fatigue were studied by fatigue tests at ambient temperature on specimens first subjected to a single period of heating with and without steady load applied. The tests employed constant amplitude loading on various structural elements in DTD 5014 (RR58) aluminum alloy material. Heating was applied at temperatures in the range 100 to 170 C for times ranging from 1h to 20000h. The initiation of fatigue cracks was significantly affected by heating, particularly at temperatures of 110 C and higher when effects occurred comparatively rapidly. The two mechanisms of importance were changes in microstructure at the machined surface which encouraged initiation, and changes in residual stress by creep which encouraged or discouraged initiation according to the creep being compressive or tensile. Author (ESA)

N77-31305# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.

THE ABRASION CHARACTERISTICS OF CERTAIN PROTECTIVE COATINGS ON ALUMINUM AND MAGNESIUM ALLOYS

A. Campbell, W. Mortimer, and P. Thornton May 1977 21 p refs

(AD-A039848; ARLCB-TR-77028) Avail: NTIS HC A02/MF A01 CSCL 11/3

The abrasion resistances of two finishing systems, one applied to 2014 aluminum and the other to ZK60A magnesium, were evaluated. Both alloys were first anodized. Subsequently, a blue-wash primer and semigloss paint were applied to the 2014 aluminum; the ZK60A magnesium received a polyamide primer and a polyurethane topcoat. The tests, performed to compare the relative abrasion resistances of the two systems, were carried out using the Taber Abraser Model 503. Abrasion rates were measured by a weight-loss technique. Analysis of the data indicated that, under the test conditions applied, the topcoats contributed little to the overall abrasion resistance of the two coating systems; rather, the anodic layer of each appeared to be the most important parameter. Further, the rate of abrasion of the anodic layer was relatively constant in each case and could be approximated by a straight line relationship. The anodic film on the 2014 aluminum demonstrated significantly better resistance to abrasion than that on the ZK60A magnesium. Author (GRA)

N77-31306# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

ON THE EQUILIBRIUM SILICIDE IN BETA TI-V ALLOYS CONTAINING SI

G. W. Franti and D. A. Koss May 1977 9 p refs (Contract N00014-76-C-0037)

(AD-A040957; TR-6) Avail: NTIS HC A02/MF A01 CSCL 20/2

Both X-ray and electron diffraction observations are presented indicating the presence of a tetragonal silicide, which is concluded to be the equilibrium phase in Ti-30 to 40V-1Si alloys aged at approx. 600 C. This silicide probably has the chemistry of (Ti,V)3Si but conceivably could be a tetragonal (Ti,V)5Si3 phase. Author (GRA)

N77-31307# Army Materials and Mechanics Research Center, Watertown, Mass.

AC-PERMEABILITY MEASUREMENT OF STRAIN-INDUCED MARTENSITE DURING TENSILE DEFORMATION OF TRIP STEELS Final Report

Gregory B. Olson, Morris Azrin, and Hans E. Band Mar. 1977 20 p

(AD-A040419; AMMRC-TR-77-10) Avail: NTIS HC A02/MF A01 CSCL 11/6

An AC magnetic permeability method has been developed for continuously monitoring the course of the strain-induced martensitic transformation during tensile deformation of TRIP steels. True stress-strain and magnetic measurements were made simultaneously during both inhomogeneous deformation (Luders-band formation) and uniform flow. Calibration with quantitative optical metallography and density measurements indicates that the AC-permeability technique yields accurate curves for the volume fraction martensite versus plastic strain. The transformation curve in high-strength TRIP steel has a sigmoidal shape consistent with that reported for lower strength austenitic steels. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-31308* National Aeronautics and Space Administration. Pasadena Office, Calif.
OIL AND FAT ABSORBING POLYMERS Patent
Harold E. Marsh, Jr., inventor (to NASA) (JPL) Issued 2 Aug. 1977 6 p Filed 7 Apr. 1976 Supersedes N76-26345 (14 - 17, p 2174) Continuation-in-part of abandoned US Patent Appl. SN-228229, filed 22 Feb. 1972 Sponsored by NASA
(NASA-Case-NPO-11609-2; US-Patent-4,039-489; US-Patent-Appl-SN-674700; US-Patent-Class-260-2.5A; US-Patent-Class-210-40; US-Patent-Class-210-DIG.27; US-Patent-Class-260-2.5AM; US-Patent-Class-260-2.5AY; US-Patent-Class-260-77.5AP; US-Patent-Appl-SN-228229)
Avail: US Patent Office CSCL 07C

A method is described for forming a solid network polymer having a minimal amount of crosslinking for use in absorbing fats and oils. The polymer remains solid at a swelling ratio in oil or fat of at least ten and provides an oil absorption greater than 900 weight percent.
Official Gazette of the U.S. Patent Office

N77-31309 Syracuse Univ., N. Y.
LIGHT-INDUCED CONFORMATIONAL REGULATION OF MACROMOLECULAR SYSTEMS Ph.D. Thesis
Robert Gerard Hoguet 1976 179 p
Avail: Univ. Microfilms Order No. 77-9861

Photoresponsive systems were prepared which contain small amounts of photochromic azo moieties bound to macromolecules which have a labile fold structure. Investigations of the dyes were conducted in dilute solution and in thin films of low crosslinking density to determine the effect of light on the conformation properties of the macromolecules. Potentimetric titration, viscosity, and equilibrium dialysis techniques were used to investigate three aqueous systems. Three types of crosslinked films were prepared. Dilation of the film strips in buffer solutions was observed with photoisomerization of the dyes. Contraction of the films occurred with the thermal isomerization of the dyes. Dissert. Abstr.

N77-31310 Tennessee Univ., Knoxville.
PHOTOCHEMICALLY INDUCED POLYMERIZATION AND MODIFICATION OF POLYMERS Ph.D. Thesis
Stuart Lansing Watson, Jr. 1976 146 p
Avail: NTIS Avail: Univ. Microfilms Order No. 77-10814

The interaction of triplet benzophenone and amines containing alkyl groups was investigated through ultraviolet irradiation with respect to formation of free radicals capable of initiating polymerization. The three different types of systems investigated included homogeneous solution, and heterogeneous graft polymerization onto an insoluble substrate. Dissert. Abstr.

N77-31311 Lehigh Univ., Bethlehem, Pa.
SYNTHESIS, CHARACTERIZATION, AND BEHAVIOR OF INTERPENETRATING POLYMER NETWORKS AND SOLUTION GRAFT COPOLYMERS BASED ON CASTOR OIL AND POLYSTYRENE Ph.D. Thesis
Godfrey Molo Yenwo 1976 139 p
Avail: Univ. Microfilms Order No. 77-10707

Interpenetrating Polymer Networks (IPN's) and solution graft copolymers based on castor oil and polystyrene or poly-(methyl methacrylate) have been synthesized using sulfur, 2,4 tolylene diisocyanate 80/20:2,4/2,6 tolylene diisocyanate, and hexamethylene diisocyanate as crosslinkers for the castor oil component. The polystyrene domain size decreased (with increasing crosslink level of the castor oil phase and with increasing polystyrene content. At low polystyrene contents the castor oil-urethane/ps IPN's yielded stress-strain behavior similar to reinforced elastomers, but at high polystyrene contents they behaved as rubber toughened plastics. The impact properties of the copolymer were the same as for homopolymer polystyrene. Evidence of yielding was demonstrated by stress-strain analysis. Dissert. Abstr.

N77-31312 Polish Academy of Sciences, Warsaw.
SELECTED STUDIES OF POLYURETHANE GLUES AS ILLUSTRATED BY SHOE GLUES [WYBRANE BADANIA KLEJOW POLIURETANOWYCH NA PRZYKLADZIE KLEJOW OBUWNICZYCH]
Tadeusz Pawlowski 17 Nov. 1976 25 p refs In POLISH
Copyright. Avail: Issuing Activity

The physico-chemical and mechanical properties of polyurethane glues were studied to establish the relative merits of various types of flues made from polyurethane polymers. At the same time, the optimal parameters for the process of gluing are determined, i.e., drying time, temperature, activization time, pressure. The two-component polyurethane glue 'Vinycol 782A' (produced in France), the two-componment polyurethane glue 'Fanadur 845' (produced in Switzerland), and the polychloroprene glue 'Butaterm' (produced in Poland) are tested and evaluated.
Author

N77-31313*# Ultrasystems, Inc., Irvine, Calif.
CROSS LINKING AND DEGRADATION MECHANISMS IN MODEL SEALANT CANDIDATES Annual Report
K. L. Paciorek, J. Kaufman, T. I. Ito, J. H. Nakahara, and R. H. Kratzer Apr. 1977 40 p refs
(Contract NAS2-7981)
(NASA-CR-151998; SN-8249-A2; AR-2) Avail: NTIS HC A03/MF A01 CSCL 11A

Model compounds were investigated as to which type of heterocyclic ring is the most advantageous for curing sealants based on perfluoroalkylether chains. The relative thermal, thermal oxidative, hydrolytic, and fuel stability of potential crosslinks were determined. Specifically substituted materials were synthesized and evaluation of their stabilities in air, inert atmosphere, water, and Jet-A fuel at 235 and 325 C was made. Three heterocyclic ring systems were considered, namely, triazine, 1,2,4- and 1,3,4-oxadiazoles. Author

N77-31314*# Dodge Cork Co., Inc. Lancaster, Pa.
MOLDABLE CORK ABLATION MATERIAL Final Report
Aug. 1977 30 p
(Contract NAS8-32317)
(NASA-CR-150382) Avail: NTIS HC A03/MF A01 CSCL 11G

A successful thermal ablative material was manufactured. Moldable cork sheets were tested for density, tensile strength, tensile elongation, thermal conductivity, compression set, and specific heat. A moldable cork sheet, therefore, was established as a realistic product. G.D.H.

N77-31315# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
LOW-TEMPERATURE POLYMERIZATION OF METHYL METHACRYLATE, 2
Jerome Rubin Apr. 1977 17 p refs
(AD-A039580; ARLCD-MR-77002) Avail: NTIS HC A02/MF A01 CSCL 07/3

A technique has been developed for the bulk polymerization of methyl methacrylate that makes feasible the use of this material in the presence of some thermally sensitive energetic materials. Low-temperature bulk polymerization of methyl methacrylate can be achieved either by polymerizing the monomer in the presence of a plasticizer or by continuing polymerization of a partially polymerized inhibited monomer. In either case, the exotherm can be kept below 100 C. The temperature generated during the reaction is dependent upon both the concentration of peroxide added, and the time needed to solidify. A partially polymerized inhibited methyl methacrylate monomer containing an excess of amine is stable to further spontaneous polymerization.
Author (GRA)

N77-31316# California Univ., Berkeley. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF ENTANGLED POLYMERS. 3: THE TRANSIENT NETWORK MODEL
S. D. Hong, D. Soong, and M. Shen 1 May 1977 33 p refs
(Contract N00014-75-C-0955)
(AD-A039976; TR-12) Avail: NTIS HC A03/MF A01 CSCL 07/3

The viscoelastic behavior of entangled polymers is modeled by a three dimensional transient network where the entangled points are considered to act as temporary crosslinks. Polymer chains are represented by beads and springs. The effect of entanglements on chain dynamic are introduced by assigning enhanced frictional coefficients to selected beads, and extra elastic couplings between pairs of the entangled beads. The

formation and disengagement of the entanglements can be envisioned to be in a dynamic equilibrium. The strength of elastic coupling is set to decrease with increasing the distance between the entangled points. The resulting modified Rouse-Bueche-Zimm matrix is solved for the relaxation times from which the dynamic moduli, relaxation moduli, steady-state shear compliance, and zero-shear viscosity are computed. Results are in excellent agreement with experimental data on monodisperse polystyrene, poly-alpha-methylstyrene, polyvinyl acetate and polybutadiene.
Author (GRA)

N77-31317# Princeton Univ., N. J. Dept. of Chemical Engineering.
PYROLYSIS-MOLECULAR WEIGHT CHROMATOGRAPHY-VAPOR PHASE INFRARED SPECTROPHOTOMETRY: AN ON-LINE SYSTEM FOR ANALYSIS OF POLYMERS. 4: INFLUENCE OF CIS/TRANS RATIO ON THE THERMAL DEGRADATION OF 1,4-POLYBUTADIENES Technical Report, Mar. 1976 - Mar. 1977
John K. Gillham May 1977 32 p refs
(Contract N00014-76-C-0200)
(AD-A040557; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07/3

The influence of the cis/trans ratio of 1,4-polybutadienes on the volatile products formed during temperature programmed thermal degradation to 15 percent weight loss has been investigated using a mass chromatograph (a chromatograph which directly provides mass numbers of resolved components of a mixture) and an 'on the fly' vapor phase infrared spectrophotometer. In order of amounts, major volatile products were 4-vinyl-1-cyclohexene (dimer), 1,3-butadiene (monomer), cyclopentene and 1,3-cyclohexadiene. With increasing trans content the relative quantities of 4-vinyl-1-cyclohexene decreased strongly, cyclopentene increased strongly, 1,3-butadiene decreased moderately and 1,3-cyclohexadiene increased moderately. For a high trans polybutadiene, increasing the heating rate produced relatively more monomer and dimer but less cyclopentene. Mass chromatograms from 1,4-polybutadienes which had been heated to 15 percent weight loss in their prehistory were similar to those obtained from 1,2-poly-butadiene indicating that 1,4-polybutadiene undergoes isomerization prior to degradation. Mechanisms for the fromation of the main volatile products of decomposition are discussed. Author (GRA)

N77-31318# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
STRENGTHENING MECHANISMS IN HIGH TEMPERATURE CERAMICS Final Report, 1 Sep. 1969 - 22 Feb. 1977
A. H. Heuer and T. E. Mitchell 22 Feb. 1977 7 p refs
(Grants DA-ARO(D)-31-124-70-G16; DA-ARO(T)-31-124-73-G95; DAAG29-76-G-0149)
(AD-A040531; ARO-13496.1-MS; ARO-7920.3-MC) Avail: NTIS HC A02/MF A01 CSCL 11/2

Summaries of the research accomplishments are listed as follows; Al2O3, MgAl2O4 and TiO2-SnO2. Discussion of each is keyed to the Appendix. GRA

N77-31319# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.
SUMMARY OF RESEARCH ON STRUCTURAL RELAXATION, ELECTRICAL RELAXATION, PHASE SEPARATION AND MICROSTRUCTURE IN GLASSES Final Report, 1 Sep. 1971 - 31 Aug. 1976
T. A. Litovitz, P. B. Macedo, C. T. Moynihan, P. K. Gupta, and J. H. Simmons 31 Mar. 1977 42 p
(Grant AF-AFOSR-2203-72)
(AD-A040192; AFOSR-77-0648TR) Avail: NTIS HC A03/MF A01 CSCL 11/2

The study of glasses and glass-forming liquids (vitreous materials) constituted an area of basic research in chemistry rich in immediate applications to technology of importance to the Air Force. The fundamental output of this contract has been 18 basic scientific publications in the general areas of (1) micro-structure and phase separation, (2) electrical relaxation phenomena and (3) viscoelastic and structural relaxation in molten glasses. Author (GRA)

N77-31320# Solar, San Diego, Calif.
STUDY OF EROSION MECHANISMS OF ENGINEERING CERAMICS Interim Technical Report, 1 Jan. 1976 - 31 Mar. 1977
Mary Ellen Gulden Apr. 1977 37 p refs
(Contract N00014-73-C-0401; NR Proj. 032-542)
(AD-A040341; RDR-1778-7; IR-5) Avail: NTIS HC A03/MF A01 CSCL 11/2

Erosion behavior of hot pressed and reaction bonded Si3N4 was determined using natural quartz particles in the subsonic velocity regime. Six narrow size ranges were used varying between 15 and 385 micrometers average diameter. Erosion behavior of these two forms of Si3N4 was markedly different. It was found that erosion of hot pressed Si3N4 was proportional to particle momentum (mass x velocity) over five orders of magnitude. Erosion of reaction bonded silicon nitride was approximately proportional to the fourth order of both particle size and velocity. Strength of hot pressed Si3N4 was not reduced under these test conditions. However, a major strength decrease was exhibited by the reaction bonded material. Examination revealed that erosion or impact of these materials under these test conditions did not clearly fit the current models for brittle materials, and that more than one mechanism exists. A small test program was performed on a MgF2 target impacted with large SiC particles used as an additive in some aircraft carrier decking. It was found that cracking and material loss was sustained by the target at velocities as low as 15 mps. Author (GRA)

N77-31321# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
SYNTHESIS OF ELECTRICALLY-CONDUCTING ORGANIC POLYMERS: HALOGEN DERIVATIVES OF POLYACETYLENE, (CH) SUB x
Hideki Shirakawa, Edwin J. Louis, Alan G. MacDiarmid, Chuan K. Chiang, and Alan J. Heeger 14 Jul. 1977 13 p ref Submitted for publication
(Contract N00014-75-C-0962; NR Proj. 356-602)
(AD-A041866; LRSM-TR-77-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

When silvery films of the semiconducting polymer, trans (polyacetylene), (CH)x, are exposed to chlorine, bromine or iodine vapor, uptake of halogen occurs, and the electrical conductivity increases markedly (over seven orders of magnitude in the case of iodine) to give, depending on the extent of halogenation, silvery or silvery-black films, some of which have a remarkably high conductivity at room temperature. Author (GRA)

N77-31322# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
PHYSICAL PROPERTIES OF HALTHANE SERIES ADHESIVES, PART 1
H. W. Lichte 1976 6 p refs Revised
(Contract EY-76-C-04-0487)
(MHSMP-76-30A-Pt-1) Avail: NTIS HC A02/MF A01

The Halthane series of urethane adhesives were studied for application to assembly processes. The series consists of three each two part systems designated 73-14, 73-18, and 87-1. The 73-18 system to be used was chosen as the first of the three for physical property testing. Systems 73-14 and 73-18 have a lower viscosity than 87-1. System 73-18 has a lower tensile and compressive modulus than 73-14 and 87-1. All three systems reach two third hardness in 16 hours. These adhesives were investigated. Measurement of bulk viscosity, cure time, butt tensile strength, lap shear strength, hardness and compatibility were included. ERA

N77-31323# Argonne National Lab., Ill. Material Science Div.
CERAMIC COATINGS FOR COMPONENTS EXPOSED TO COAL-GAS ENVIRONMENTS: A REVIEW
R. Swaroop Dec. 1976 34 p refs
(Contract W-31-109-eng-38)
(ANL-76-124) Avail: NTIS HC A03/MF A01

The corrosive and erosive environments at high temperatures and pressures in coal gasifiers impose severe requirements on the alloys of fabrication. A concise review of the application of ceramic coatings to resist coal-gas environments was conducted. This review attempts to explore suitable ceramic or cermet

materials that may resist or retard the degradation of metal components and to summarize the state of the art of various methods of producing such coatings. ERA

N77-31324# National Physical Lab., Teddington (England). Div. of Chemical Standards.
COMPRESSION OF ELASTOMERIC SEAL MATERIALS AT PRESSURES UP TO 3.5 GN sqm
G. ONeill Aug. 1976 12 p refs
(NPL-Chem-54) Avail: NTIS HC A02/MF A01

A solid-phase piston-cylinder unit was used to measure the compression of elastomers suitable for use as O-ring seals at high pressures in order to collect compression data required in the design and construction of a 45-kilobar gaseous environment apparatus. The change in volume of the sample is related to the displacement of the piston. Corrections which have to be made to the measured piston heights before calculating compressions are analyzed. The percentage compressions of the various elastomers used are plotted against the pressure and the experimental results were found fitted by a least squares method to a modified Tait equation. ESA

N77-31325# Naval Civil Engineering Lab., Port Hueneme, Calif.
POLYMER-MODIFIED CONCRETE FOR MILITARY CONSTRUCTION Final Report, Jul. 1973 - Jun. 1975
J. R. Keeton and R. L. Alumbaugh Apr. 1977 77 p refs
(AD-A039801; CEL-TN-1479) Avail: NTIS HC A05/MF A01 CSCL 11/2

Results are given of tests made with polymer-modified concretes in which the polymeric materials are added to the concrete in the mixer. Polymers used were either epoxy or saran latex. Epoxy- or latex-modified concretes provided compressive, splitting tensile, and flexural strengths from 2.8 to 4.6 times those of similar concrete without the polymer. Epoxy-modified concretes achieved compressive strengths from 7,770 psi to 10,150 psi over test ages of 1 day to 365 days. Latex-modified concretes reached compressive strengths from 4,160 psi to 10,110 psi over test ages from 3 days to 365 days. Splitting tensile strengths of epoxy-modified concretes ranged from 900 psi to 1,340 psi for test ages from 1 day to 365 days; corresponding strengths of latex-modified concretes ranged from 600 psi to 970 psi. Flexural strengths of epoxy-modified concretes ranged from 1,300 psi to 1,610 psi; corresponding strengths of latex-modified concretes ranged from 770 psi to 1,570 psi; Significant reductions were observed in water absorption of polymer-modified concretes. Bond strength of polymer-modified concrete was slightly higher than in concrete without the polymer Young's moduli of polymer-modified concretes were only 1.4 to 1.8 times those of similar concrete without the polymer. GRA

N77-31326# Army Materials and Mechanics Research Center, Watertown, Mass.
RECENT DEVELOPMENTS IN HIGH PERFORMANCE CERAMICS Final Report
R. Nathan Katz Mar. 1977 22 p refs Presented at the Ann. Meeting of the Amer. Phys. Soc.
(ARPA Order 1849)
(AD-A039358; AMMRC-MS-77-4) Avail: NTIS HC A02/MF A01 CSCL 11/2

Newly developed ceramic materials, fabrication processes, and advances in brittle materials design capability are having a significant impact on our ability to utilize ceramics as substitute materials. This paper will briefly review ceramic materials and their methods of fabrication. We will then consider the use of silicon nitride and silicon carbide ceramics in hot flow path components of gas turbines. Emphasis will be on the advantages of ceramics of this application, materials, and progress to date. Application of single and polycrystalline ceramics to optical systems such as high energy lasers will be reviewed. The detailed characterization and manipulation of grain boundaries in ceramics will be seen to be of great importance in both the high temperature structural and advanced optical areas of application. Author (GRA)

N77-31327# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.
COMPOUNDING ELASTOMERS FOR USE IN ARMAMENT APPLICATIONS Technical Report, Jul. 1975 - Jun. 1976
James D. Ruby, Frank B. Testroet, and John A. Williams Feb. 1977 41 p
(AD-A039847; RIA-R-TR-77-010) Avail: NTIS HC A03/MF A01 CSCL 11/10

A commercial masterbatch of a phosphonitrilic polymer proved to be much easier to mill-mix than the gum elastomer itself. Vanfre AP-2 processing aid improved the mold flow of a nitrile-based compound developed for use in the fabrication of oil seals. Antox N was found to be a suitable antioxidant to replace Neozone D that has been removed from the market. The shape factor of 175mm neoprene rubber obturator pads was reduced by the placement of blind holes in one pad surface, hence the low-temperature compressibility was improved. Satisfactory compounds, based on polymer blends, were developed for potential use in the fabrication of obturator pads, barrier bags for the 152mm combustible-cased round, and seals for use in flame-resistant hydraulic fluid. Author (GRA)

N77-31328# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
ADHESION OF FILMS OF MoS2 TO OXIDIZED METAL SURFACES Interim Report
Gary W. Stupian and Armond B. Chase 19 Apr. 1977 35 p refs
(Contract F04701-76-C-0077)
(AD-A039775; TR-0077(2270-30)-4; Samso-TR-77-92) Avail: NTIS HC A03/MF A01 CSCL 07/4

The adhesion of MoS2 (a layer-lattice compound used as a solid lubricant), burnished by a standard procedure onto various metal substrates, has been investigated. The degree of adhesion, as determined by microscopic examination of the burnished surfaces, has been related to differences in states of surface oxygen observed by X-ray photoelectron spectroscopy and Auger electron spectroscopy. Experimental data confirm our previously reported conclusion that the substrate metal-sulfur bond strength is of primary importance in MoS2 adhesion. However, the substrate metal atoms must be accessible to sulfur in order for these bonds to form. On some metals, e.g., copper, it was found that surface oxygen is not present as an oxide but exists in a precursor state less tightly bound than an oxide. The formation of substrate metal-sulfur bonds by displacement of oxygen is facilitated by the existence of this precursor state. On metals with more stable surface oxides, e.g., titanium, oxygen lattice vacancies are present that again expose surface metal atoms to sulfur. Experiments in which MoS2 films were burnished onto both oxidized metals and metal oxide single crystals are reported here. All results are consistently interpreted in terms of the nature of the oxygen initially present on the metal surface.
Author (GRA)

N77-31329# Princeton Univ., N. J. Dept. of Chemical Engineering.
THE T SUB II RELAXATION OF POLYSTYRENE Technical Report, Mar. 1976 - Apr. 1977
John K. Gillham and Raymond F. Boyer Jun. 1977 61 p refs
(Contract N00014-76-C-0200)
(AD-A040558; TR-11) Avail: NTIS HC A04/MF A01 CSCL 07/3

A review of recent work on a relaxation (T sub II) above the glass transition (T sub g) of amorphous polystyrene is presented. On the basis of experimental data from torsional braid analysis (TBA), differential scanning calorimetry (DSC) and differential thermal analysis (DTA), and of an examination of the literature, it is suggested that T sub II represents a molecularly-based transition. Author (GRA)

N77-31330# Iowa Univ., Iowa City. Dept. of Chemistry.
HEAT STABLE POLYMERS: POLYPHENYLENE AND OTHER AROMATIC POLYMERS Final Report, Jan. 1974 - Dec. 1976
J. K. Stille 1 Jan. 1977 52 p refs
(Grant DAAG29-74-G-0023)
(AD-A040386; ARO-11754.7-C) Avail: NTIS HC A04/MF A01 CSCL 07/3

Along with the developments in the aerospace industry and other advanced technology came an increased demand for new materials that could withstand severe environmental conditions.

The greatest emphasis has been placed on the development of materials capable of withstanding temperatures up to 350 C for periods up to 400 hrs, or temperatures up to 350 C for 80 hrs. These demands for thermal stability might appear to be outside the capabilities of an organic material, yet there is good evidence that specially synthesized organic polymers, particularly those that are composed entirely of aromatic rings or aromatic rings linked by stable connecting groups, would serve the necessary functions of a structural material and at the same time be thermally stable. Step-growth polymerizations offer the more attractive means of synthesis of such stable rigid chain polymers, particularly those polymerizations that produce aromatic rings as the polymer-forming reaction. Linear rigid chain macromolecules generally exhibit greater mechanical strength and higher phase transition temperature than the more flexible chain polymers. Author (GRA)

N77-31331# Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
ASPHALT-RUBBER MIXTURES FOR SEEPAGE CONTROL M.S. Thesis
Reda Mohieddine Kalash 1977 93 p refs
(Contract DI-14-34-0001-7006; OWRT Proj. A-075-ARIZ(1))
(PB-267667/4; W77-08195) Avail: NTIS HC A05/MF A01 CSCL 11G

A laboratory investigation was made of asphalt rubber for use in water seepage control applications. Laboratory testing used for physical property determinations included viscosity, creep(tensile) ductility, water vapor transmission, water absorption and permeability. The results showed that the asphalt rubber is relatively impermeable as a membrane. Physical properties of the base asphalt that are increased with the addition of rubber include water absorption and viscosity. The test that exhibited lower physical property values was ductility. Compared with plain asphalt, creep (tensile) test results showed that the rate of deformation of asphalt rubber mixtures depends on the magnitude of the tensile load applied. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-31332*# Florida Inst. of Tech., Melbourne.
DISPOSAL OF HYPERGOLIC PROPELLANTS. PHASE 6, TASK 1: THE CRYOGENIC SCRUBBER PROTOTYPE Final Report
John Thomas, Henry E. Sivik, Edward Folger, and Eugene Spearman Aug. 1976 32 p
(Contract NAS10-8399)
(NASA-CR-147909) Avail: NTIS HC A03/MF A01 CSCL 21D

A cryogenic scrubber prototype (CSP) was evaluated as a means of removing monomethylhydrazine (MMH) vapor and dinitrogen textroxide (NTO) vapor from nitrogen or helium vent gas stream. The concept, laboratory data, design, construction and experimentation are discussed. Author

N77-31333*# Florida Inst. of Tech., Melbourne.
DISPOSAL OF HYPERGOLIC PROPELLANTS. PHASE 6, TASK 3: PROTOTYPE DISPOSAL POND
Henry E. Sivik and Craig N. Wiederhold Jun. 1977 130 p Original contains color illustrations
(Contract NAS10-8399)
(NASA-CR-147910) Avail: NTIS HC A07/MF A01 CSCL 21D

The design and operation of a prototype diposal of hypergolic propellants waste are described. Experiments with water hyacinths were performed. Author

N77-31334# RAND Corp., Santa Monica, Calif.
AN EVALUATION OF VERY LARGE AIRPLANES AND ALTERNATIVE FUELS Interim Report
W. T. Mikolowsky, L. W. Noggle, W. F. Hederman, and R. E. Horvath Dec. 1976 401 p refs
(Contract F49620-77-C-0023)
(AD-A040532; R-1889-AF) Avail: NTIS HC A18/MF A01 CSCL 01/3

Very large airplanes using alternative fuels are examined in the context of existing and possible future Air Force missions. Synthetic jet fuel (JP), liquid methane, liquid hydrogen, and nuclear propulsion are the fuel alternatives selected for detailed analysis. Conceptual designs of airplanes using each of these fuels were developed and estimates were made of their life-cycle cost and life-cycle energy consumption. Mission analyses were performed to determine the effectiveness of the alternative airplanes in strategic airlift specifically and in the station-keeping role in general. Results indicate that for most military applications airplanes with gross weights in excess of one million pounds promise to be superior to any comtemporary airplanes in terms of cost-effectiveness and energy-hydrocarbon jet fuel, whether manufactured from oil shale, coal or crude oil, remains the most attractive aviation fuel for future Air Force use. Policy recommendations are made pertaining both to alternative fuels and to advanced-technology large airplanes. Future research and developments are also identified. Author (GRA)

N77-31335# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 A AND B STAGE I TP-H1011 Semiannual Test Report
John A. Thompson Apr. 1977 114 p
(AD-A041591; MANCP-367(77)) Avail: NTIS MF A01 CSCL 21/8

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 A and B First Stage Minuteman Motors. This report is the twelfth time that a statistical approach has been used to analyze First Stage bulk carton propellant. Testing was accomplished in accordance with MMEMP Project M72632 - 5MP116P. The purpose of testing was to determine and provide early warning of any serious degradation trends occurring in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected in the propellant for at least two years past the oldest data point. Data stored in the G085 System were plotted utilizing the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the G085 System. Each point on the regression plot represents the mean of all samples at the particular age. The number of specimens at each point is indicated on the sample size summary sheet accompanying each regression plot or group of regression plots. Author (GRA)

N77-31336# Kentucky Univ., Lexington.
TECHNOECONOMIC ANALYSIS OF LARGE SCALE THERMONUCLEAR PRODUCTION OF HYDROGEN Final Report
James E. Funk Dec. 1976 180 p refs Prepared in cooperation with CE-Lummus, Bloomfield, N.J.
(EPRI Proj. 467)
(EPRI-EM-287) Avail: NTIS HC A09/MF A01

Capital and operating costs and overall process efficiency are presented for a four-reaction thermochemical process which produces hydrogen from water. These results were obtained from a detailed preliminary plant design which was made after the selection of a suitable process and the establishment of a design basis. Selection of an appropriate process involved the evaluation of estimated process efficiency, materials problems, and availability of data for known thermochemical cycles. This initial screening resulted in the identification of four cycles which appeared promising in terms of low cost and efficient hydrogen production. A more detailed analysis of these four cycles included the preparation of mass and energy balances including the interface with the nuclear heat source and the specification of separation techniques, operating conditions, etc. Process thermal efficiency was re-estimated and the problems involved in the design of a large-scale plant were evaluated in more detail. ERA

N77-31337# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
HYDROGEN GENERATION PROCESS Quarterly Technical

Progress Report, 17 May - 16 Aug. 1976
G. H. Farbman and L. E. Brecher Sep. 1976 63 p refs
(Contract EX-76-C-01-2262)
(FE-2262-3) Avail: NTIS HC A04/MF A01

The technical and economic feasibility of a hybrid electrolytic-thermochemical hydrogen generation process based upon the electrolysis of sulfurous acid is examined. The operating characteristics of key process steps in the hydrogen generating cycle are determined and engineering and economic analyses performed to evaluate the system are described. Emphasis is placed on finding alternate sources of energy as well as methods to prolong the lifetime of remaining fossil fuels. J.M.S.

N77-31338# Pennsylvania State Univ., University Park. Coal Research Section.
EVALUATION AND DEVELOPMENT OF SPECIAL PURPOSE COALS Final Report
W. Spackman, A. Davis, P. L. Walker, H. L. Lovell, R. Stefanko, R. H. Essenhigh, F. J. Vastola, and P. H. Given Sep. 1976 434 p refs
(Contract E(49-18)-0390)
(FE-0390-2) Avail: NTIS HC A19/MF A01

Two hundred eighty-six coals from throughout the nation sampled and analyzed. Trends in the maceral contents of U.S. coals with respect to geographic location exist. Younger, western coal basins show higher resinite contents than eastern coals. The nature and amount of mineral matter and major and trace elements varies widely, even within a given coal seam. A minimum for the Hardgrove Grindability of American coals occurs when volatile matter is approximately equal to 50%. Coals are most friable when volatile matter nears 20%. Fractionation studies of coals indicate that specialized feedstocks for conversion processes are feasible. DryFlo separations resulted in significant ash and S reductions. Optimum yields in batch autoclave liquefaction tests occured with coals of the high volatile bituminous rank and where concentrations of virinite and exinite were high. The pore structure of coals varies with rank. Gasification results in an expansion of the pore structure of coals and chars. ERA

N77-31339# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
DEVELOPMENT OF HIGH STABILITY FUEL. EXECUTIVE SUMMARY Technical Report, 15 Dec. 1969 - 30 Nov. 1976
William F. Taylor and John W. Frankenfeld Feb. 1977 12 p refs
(Contract N00140-74-C-0618)
(AD-A039977; EXXON/GRU.18GAHF.77) Avail: NTIS HC A02/MF A01 CSCL 21/4

This report contains an Executive Summary of the work done on the Development of High Stability Fuel program which was carried out by the Government Research Laboratories of Exxon Research and Engineering Company for the Department of the Navy. The overall program consisted of an initial analytical study entitled, 'Investigation and Analysis of Advanced Hydrocarbon Fluids' followed by an extended experimental effort entitled 'Development of High Stability Fuel.' The Executive Summary discusses the following areas: (1) General Background, (2) Program Background, (3) Program objective and Approach, (4) Major Features of the Technology Which Was Developed, (5) Present Significance of This Technology, (6) Significance of This Technology for High Speed Aircraft, and (7) Significance in Relation to Future Synthetic Fuels. Author (GRA)

N77-31340# IIT Research Inst., Chicago, Ill.
BLAST PARAMETERS OF BS-NACO-PROPELLANT Final Report
J. J. Swatosh, J. R. Cook, and P. Price Apr. 1977 51 p
(Contract DAAA21-75-C-0521)
(AD-A039527; IITRI-J6342-8; ARLCD-CR-77003) HC A04/MF A01 CSCL 19/1

Experiments were performed with BS-NACO propellant in subscale and full-scale shipping/storage drum configurations and in full-scale conically shaped feed hopper configurations to determine the air-blast pressure and positive impulse resulting from the detonation of the material. Peak pressure and positive impulse were measured in the scaled distance range of approximately the cube root of 2 to 25 ft/lb. TNT equivalency curves for both pressure and impulse were developed as a function of scaled distance. Based on the test results, BS-NACO propellant should be considered QD Class 2 material while in-process. Author (GRA)

N77-31341# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.
A MODEL OF EROSIVE BURNING OF COMPOSITE PROPELLANTS
Merrill K. King 1977 13 p
(Contract F44620-76-C-0023)
(AD-A040459; AFOSR-77-0692TR) Avail: NTIS HC A02/MF A01 CSCL 21/9

Development of solid rocket motor designs which result in high velocity flows of product gases across burning propellant surfaces(notably, nozzleless rocket motors) is leading to increased occurrence of erosive burning. In this paper, a physically realistic picture of the effect of such crossflow on composite propellant combustion, based on the bending of columnar diffusion flames by the crossflow, is presented. This bending results in shifting of the diffusion flame heat release zone toward the surface, with consequent increased heat feedback flux from this flame to the surface and thus increased burning rate. A relatively simple analytical model based on this picture is developed for prediction of propellant burnings rate as a function of pressure and crossflow velocity, given only zero-crossflow burning rate versus pressure data. Model predictions and experimental results are compared, with reasonably good agreement being found. Author (GRA)

N77-31342# Naval Research Lab., Washington, D. C.
PULSED HIGH PRESSURE GAS GENERATOR FOR THE LINUS-O SYSTEM Memorandum Report
R. D. Ford, D. J. Jenkins, and P. T. Turchi Jun. 1977 19 p refs
(AD-A041826; NRL-MR-3537) Avail: NTIS HC A02/MF A01 CSCL 19/1

In this report the high explosive DATB is evaluated for use in a nondestructive pulsed high pressure gas system. A test configuration is described which permits measurement of acceleration and velocity of a free piston driven at various pressures generated by detonating small DATB charges. Test results are described and applicability to the LINUS-O system is considered. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-31343# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
RECOMMENDATIONS FOR THE DESIGN AND EQUIPPING OF ENGINEERING METROLOGY LABORATORIES
T. Fletcher, ed. Mar. 1977 29 p refs Supersedes NPL-MC-4-Rev; see N72-29217
(NPL-MOM-22; NPL-MC-4-Rev) Avail: NTIS HC A03/MF A01

Suggestions are made for size, site, general design features, atmospheric control, equipment, and other factors which affect the satisfactory functioning of an engineering metrology laboratory. A bibliography and a list of some suppliers of equipment is included. Author (ESA)

N77-31344# Florida Univ., Gainesville. Dept. of Engineering Science Mechanics and Aerospace Engineering.
MODULAR SYSTEMS THEORY AND DESIGN ANALYSIS Final Report
William H. Boykin, Steven W. Director, Rudolf E. Kalman, Eginhard J. Muth, and Gale E. Nevill, Jr. 7 Jan. 1977 14 p refs
(Grant AF-AFOSR-2605-74)
(AD-A040285; AFOSR-77-0676TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

Final report of work begun on modular systems analysis and design. Includes modular concepts and optimization methods

for reduce life-cycle-cost of classes of systems with modularity constraints. Author (GRA)

N77-31345# Naval Ship Research and Development Center, Bethesda, Md.
STATIC EVALUATION OF A CIRCULATION CONTROL CENTRIFUGAL FAN Interim Report, Jan. - Dec. 1975
Roger J. Furey and Robert G. Whitehead Jun. 1977 40 p
(AD-A041463; DTNSRDC-77-0051) Avail: NTIS HC A03/MF A01 CSCL 13/10

The static characteristics of a circulation control (CC) fan were determined to demonstrate the feasiblity of the CC concept as a means of meeting the lift system requirements of a large, open ocean capable, surface effect ship (SES). These requirements being, variable performance, at constant RPM, of sufficient range to provide for heave alleviation when operating at high speeds in advanced sea-states. The scope of the program included two solidity ratios within the model centrifugal impeller and, in effect, two volutes. The better performing combination of these variations was the low solidity (sigma = 0.65) impeller mated with a reduced internal volume volute. This fan demonstrated a flow rate increase of 100 percent over that achieved at the design point, through increasing the flow of control air, while maintaining a constant head rise. The peak efficiency of this combination was 83 percent. Author (GRA)

N77-31346# Texas State Dept. of Highways and Public Transportation, Austin. Bridge Div.
THE TEXAS QUICK-LOAD METHOD FOR FOUNDATION LOAD TESTING, USER'S MANUAL
H. D. Butler and Horace E. Hoy Dec. 1976 62 p refs
(Contract DOT-FH-11-8608)
(PB-267353/1; FHWA-IP-77-8) Avail: NTIS HC A04/MF A01 CSCL 13B

The Texas State Department of Highways and Public Transportation has developed and implemented a 'quick load' method for load testing piling and drilled shafts. Using the method a load test can be completed in a relatively short time of one to two hours. On small projects where the time consuming AASHTO test cannot be economically justified, use of this test makes it feasible to use full scale load tests to verify foundation designs on these jobs. Information is presented to assist highway engineers in understanding, using and applying quick load test methods as well as providing information necessary to prepare specifications and cost estimates for quick-load testing. GRA

N77-31347# RAPIDEX, Inc., Gloucester, Mass.
POTENTIAL APPLICATIONS OF PORTABLE UNDERGROUND HARDROCK CRUSHERS Final Report
Carl R. Peterson, Allan T. Fisk, and Richard E. Brooks Dec. 1976 116 p refs
(Contract DI-BM-J0-265006)
(PB-267207/9; BM-OFR-93-77) Avail: NTIS HC A06/MF A01 CSCL 08I

The optimum design parameters, and a concept for the design of a low profile, hard rock, portable underground crusher to insure that future development will lead to maximum utilization by the industry are studied. The recommended design is a rotary jaw concept. GRA

N77-31348# Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.
TEXTURING OF CONCRETE PAVEMENTS Interim Report, Jun. 1975 - 1976
Joseph E. Ross and Sheldon M. Law Sep. 1976 27 p Sponsored by Federal Highway Admin.
(PB-267772/2; LA-72-3C(B)-2; FHWA/LA-76-72-3C(B); IR-2) Avail: NTIS HC A03/MF A01 CSCL 13B

Several texturing techniques were tried and will be compared in order to determine which concrete pavement texture will perform best in regard to skid resistance, durability and uniformity. GRA

N77-31349# Westinghouse Research Labs., Pittsburgh, Pa.
STRUCTURAL MATERIALS FOR CRYOGENIC APPLICATIONS Final Technical Report
J. M. Wells, R. Kossowsky, W. A. Logsdon, and R. Daniel 9 Oct. 1976 196 p
(Contract NBS-CST-8304; ARPA Order 2569)
(RR-76-9D9-CRYMT-R1) Avail: NTIS HC A09/MF A01

Characterization, mechanical and fracture mechanics property and magnetic property determinations, and metallurgical and fractographic evaluations on the FY76 materials, namely Pyromet 538 (21 Cr-6 Ni-9 Mn) and A286 stainless steels were completed. Fracture toughness values at 4K for GTA Weldments in Pyromet 538 with matching composition filler material were only about 50% of that of the unwelded material, whereas fracture toughness values for SMA Weldments in this material with nonmatching composition filler material were equal to the unwelded base material. Strain induced martensite was observed in the Pyromet 538 material deformed at both 77 and 4K, no such martensitic transformation was observed in the A286 material, again in confirmation of earlier microstructural stability predictions. The fracture toughness of GTA Weldments in the A286 material was found to exceed that of the higher strength unweld based material. Summary compilations of all data generated are presented along with overview discussions of the significance of such data with respect to the various interdisciplinary areas involved. Author

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-31350* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
AUTOMATIC TRANSPONDER Patent
Roy E. Anderson (GE, Schenectady, N. Y.), Alex F. Brisken (GE, Schenectady, N. Y.), and James R. Lewis, inventors (to NASA) (GE, Schenectady, N. Y.) Issued 16 Aug. 1977 9 p Filed 27 Mar. 1975 Supersedes N76-19318 (14 - 10, p 1241) Sponsored by NASA
(NASA-Case-GSC-12075-1; US-Patent-4,042,926; US-Patent-Appl-SN-562499; US-Patent-Class-343-17.7) Avail: US Patent Office CSCL 17B

A method and apparatus for the automatic, remote measurement of the internal delay time of a transponder at the time of operation is provided. A small portion of the transmitted signal of the transponder is converted to the receive signal frequency of the transponder and supplied to the input of the transponder. The elapsed time between the receive signal locally generated and the receive signal causing the transmission of the transmitted signal is measured, said time being representative of or equal to the internal delay time of the transponder at the time of operation. Official Gazette of the U.S. Patent Office

N77-31351 British Broadcasting Corp., Kingswood (England). Engineering Div.
GROUND-WAVE PROPAGATION AT MEDIUM FREQUENCY IN BUILT-UP AREAS
J. H. Causebrook Jul. 1977 22 p refs Original contains color illustrations
(BBC-RD-1977/25; RA-163) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Work was carried out to seek a better understanding of the way medium frequency ground wave field strengths are influenced by buildings. Measurements were made which showed that, in and near built up areas, the field strength distance relationship is often different from that expected on the basis of conventional theories. The theory of propagation was extended and applied to explain the results. The end product is a computer calculation system for typical situations. Author

N77-31352 British Broadcasting Corp., Kingswood (England). Engineering Div.
CEEFAX: EVOLUTION AND POTENTIAL
J. R. Chew Aug. 1977 19 p refs
(BBC-RD-1977/26) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Suitably equipped domestic television receivers and the

existing television channel which feeds them were used to provide an extra service of written news and other information to the viewer. The development of the CEEFAX information broadcasting system to the end of a two-year experimental period is described. The background to the choice of transmission and display parameters is given, together with details of laboratory and field experiments. Particular emphasis is given to the selection of the addressing and coding systems to give reliable reception throughout the normal television service area. The basis for the choice of the many supplementary facilities of CEEFAX, such as color and graphics, is presented together with indication of the provisions made for future expansion in the use of CEEFAX. Author

N77-31353*# Applied Science Associates, Inc., Apex, N.C.
THE ESTIMATION OF POINTING ANGLE AND NORMALIZED SURFACE SCATTERING CROSS SECTION FROM GEOS-3 RADAR ALTIMETER MEASUREMENTS Final Report
G. S. Brown and W. J. Curry Aug. 1977 105 p refs
(Contract NAS6-2520)
(NASA-CR-141426) Avail: NTIS HC A06/MF A01 CSCL 17I

The statistical error of the pointing angle estimation technique is determined as a function of the effective receiver signal to noise ratio. Other sources of error are addressed and evaluated with inadequate calibration being of major concern. The impact of pointing error on the computation of normalized surface scattering cross section (sigma) from radar and the waveform attitude induced altitude bias is considered and quantitative results are presented. Pointing angle and sigma processing algorithms are presented along with some initial data. The intensive mode clean vs. clutter AGC calibration problem is analytically resolved. The use clutter AGC data in the intensive mode is confirmed as the correct calibration set for the sigma computations. Author

N77-31354*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACECRAFT RECEIVING ANTENNA STUDY: OUTER PLANETS ATMOSPHERIC ENTRY PROBE
E. A. Kuhlman 22 Sep. 1977 60 p refs
(Contract NAS2-9027)
(NASA-CR-137875) Avail: NTIS HC A04/MF A01 CSCL 09C

A quadrifilar helix antenna was selected for the Pioneer spacecraft receiving antenna. A model was constructed for radiation pattern measurement at 2.2 GHz. Radiation patterns were measured with the model quadrifilar helix antenna mounted on a Pioneer spacecraft model and four different configurations were tested. The results show that the antenna location does not have a major effect on its patterns over the aft hemisphere but moving the antenna away from the spacecraft improves the antenna performance. Author

N77-31355*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASDAR (AIRCRAFT TO SATELLITE DATA RELAY) FLIGHT TEST REPORT
Edward J. Domino, Robert R. Lovell, Martin J. Conroy, and David H. Culp Aug. 1977 21 p
(NASA-TM-73744; E-9311) Avail: NTIS HC A02/MF A01 CSCL 17B

The aircraft to Satellite Data Relay (ASDAR), an airborne data collection system that gathers meteorological data from existing aircraft instrumentation and relays it to ground user via a geo-synchronous meteorological satellite, is described and the results of the first test flight on a commercial Boeing 747 aircraft are presented. The flight test was successful and verified system performance in the anticipated environment. Author

N77-31356# Naval Electronics Lab. Center, San Diego, Calif.
FIBER-OPTIC UNDERSEA TWO CABLE OPTICAL AND ENVIRONMENTAL TESTS Test and Evaluation Report, 1 Apr. - 3 Dec. 1976
W. H. Putnam 20 Dec. 1976 54 p refs
(AD-A040024; NELC-TR-2006) Avail: NTIS HC A04/MF A01 CSCL 17/2

Tests of two fiber-optic cables revealed that fibers for communication purposes can be incorporated into two cables with very little excess loss during manufacture. Further development in cable design and fiber buffers is required to eliminate excess loss when cables are subjected to tension, temperature, and pressure. Author (GRA)

N77-31357# Colorado Univ., Boulder. Electromagnetics Lab.
CHARACTERISTICS OF DISCRETE PROPAGATION MODES ON A SYSTEM OF HORIZONTAL WIRES OVER A DISSIPATIVE EARTH Interim Report
Steven W. Plate, David C. Chang, and Edward F. Kuester Feb. 1977 44 p refs
(Contract F19628-76-C-0099)
(AD-A040046; TR-4; RADC-TR-77-81) Avail: NTIS HC A03/MF A01 CSCL 20/14

An equation for determining the propagation constants of the discrete modes of propagation on a system of m parallel thin wires above a dissipative earth is derived. Approximations to the Sommerfeld integrals involved in the modal equation that are accurate for relatively large values of the earth's refractive index are found and rigorous errors bounds for these approximations are obtained. Plots of the complex propagation constants for a dual bare wire line are calculated. A degeneracy is shown to exist between the two bifilar modes and in addition, one of the bifilar modes is seen to disappear into the improper Riemann sheet for small spacings between the two wires. Author (GRA)

N77-31358# Colorado Univ., Boulder. Dept. of Electrical Engineering.
MODEL CHARACTERISTICS OF SINGLE AND DUAL WIRES LOCATED OVER A DISSIPATIVE EARTH Final Report, 1 Nov. 1975 - 30 Sep. 1976
David C. Chang Mar. 1977 25 p refs
(Contract F19628-76-C-0099)
(AD-A040045; RADC-TR-77-108) Avail: NTIS HC A02/MF A01 CSCL 20/14

The objective of this research project is to investigate the characteristics of discrete guided wave modes supported by open structures near a dissipative earth. Possible engineering application is found in radar traffic control, airport surveillance and other similar problems. Since the beginning of this contract, considerable progress has been made towards a better understanding of electromagnetic propagation on thin-wire structures located above earth in general, and the characteristics of guided modes on a single or dual line of bare-wires and dielectrically-coated wire in particular. Attention also has been given to the development of excitation schemes for low attenuation modes, to the problem of mode conversion due to irregularities in the immediate vicinity of a guiding structure and to the calculation of radiation loss in the presence of bends among others. Author (GRA)

N77-31359# North Carolina State Univ., Raleigh. Signal Processing Lab.
A TELEVISION CAMERA INPUT AND DISPLAY OUTPUT BUFFER SYSTEM
J. N. England Jan. 1977 11 p
(Grant DAAG29-76-G-0133)
(AD-A040194; SPL-16; ARO-13989.5-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

A television camera input and display output buffer system has been designed and partially constructed as of January 1977. The system consists of a controller for selecting either of two camera inputs, a storage memory, a system controller, and a run-length encoder. The memory is easily expandable and currently consists of 4,096 8-bit words. The system controller selects a rectangular section from any portion of a 512 x 512 digitized image. The section may be of any size from 512 x 8 to 1 x 1 to 8 x 512. The system performs a continuous display from the memory correctly interleaved with the incoming television camera input if desired. This display can take place simultaneously with input to the memory, displaying the old image while the new image is stored. The memory system allows maximum DMA rate transfers to and from an Adage AGT/30 host computer. Author (GRA)

N77-31360# Science Applications, Inc., Berkeley, Calif.
ELECTROMAGNETIC COUPLING BETWEEN MULTICONDUCTOR TRANSMISSION LINES IN A HOMOGENEOUS MEDIUM Final Report

Tom K. Liu Kirtland AFB, N. Mex. AFWL May 1977 51 p refs
(Contract F29601-76-C-0125)
(AD-A040267; AFWL-TR-76-333) Avail: NTIS HC A04/MF A01 CSCL 20/14

The electromagnetic coupling between multiconductor transmission lines which are immersed in a homogeneous medium are investigated in this report. The method of reflection matrices is used to show how the line voltages and currents are related to the driving source voltages or currents. It is also shown that for weak coupling, the expressions for the induced voltages and currents on a conductor due to energy on another conductor may be greatly simplified. In fact, the effect of the crosscoupling can be represented by lumped voltage and/or current generators on the induced conductor. Author (GRA)

N77-31361# Stanford Research Inst., Menlo Park, Calif.
PREDICTIONS OF EFFECTS PRODUCED BY THE DICE THROW DETONATION ON EXPERIMENTAL MICROWAVE LINKS Topical Report, 1 Jan. - 30 Sep. 1976
Robert L. Bollen, V. Elaine Hatfield, Walter G. Chesnut, and Georgellen Smith Sep. 1976 127 p
(Contracts DNA001-76-C-0207; DNA001-76-C-0146)
(AD-A040907; DNA-4183T) Avail: NTIS HC A07/MF A01 CSCL 20/14

The dust clouds produced by near-surface nuclear detonations and large-yield HE simulations of these are studied in order to produce predictions of phase and amplitude fluctuations of microwave signals that transit through these clouds. Quantitative predictions are made based on theoretical predictions of the dust cloud that is expected to be produced by the 600-ton ANFO high-explosive test code-named DICE THROW. These predictions are made for the paths and frequencies that will be used in as experimental probing by microwave links of the DICE THROW dust cloud. A photographic comparison of HE and nuclear detonations is also given in order to determine the detonation altitude of a nuclear device that will be best simulated by the DICE THROW test. It is concluded that crater ejecta will dominate the DICE THROW dust cloud generation. The dust cloud geometry probably will best simulate that produced by a kiloton nuclear device buried more than several but less than (approximately) 15 feet (5 meters). Calculations, based on a particle size distribution that contains some large particles thought to be appropriate to ejecta clouds, show attenuation perhaps reaching 10 dB at X band (10,188 MHz) on some paths within the first one second following detonation. The attenuation is expected to decrease and be insignificant by approximately 10 seconds due to the fallout of large particles. GRA

N77-31362# Utah Univ., Salt Lake City. Dept. of Mathematics.
STEADY-STATE WAVE PROPAGATION IN SIMPLE AND COMPOUND ACOUSTIC WAVEGUIDES
Calvin H. Wilcox and J. C. Guillot Apr. 1976 31 p refs
(Contract N00014-76-C-0276)
(AD-A041046; TR-31) Avail: NTIS HC A03/MF A01 CSCL 20/1

A limiting absorption principle and corresponding existence theorem is presented for steady-state acoustic wave fields in simple and compound waveguides. The simple guides are semi-infinite cylinders, sectoral horns and conical horns. The compound guides are structures built by coupling one or more simple guides to a bounded cavity. The theory is developed under minimal regularity hypotheses about the waveguide walls. The class of allowable guides includes all the simple, but non-smooth, structures that arise in applications such as guides built from polyhedra and sections of cylinders, cones, spheres and other simple geometrical structures. Author (GRA)

N77-31363# Harry Diamond Labs., Adelphi, Md.
USER'S MANUAL FOR THE NLINE MULTICONDUCTOR TRANSMISSION-LINE COMPUTER CODE
Janis Klebers May 1977 59 p
(AD-A040398; HDL-TR-1803) Avail: NTIS HC A04/MF A01 CSCL 09/2

This manual describes applications of the multiconductor transmission-line computer program, NLINE. The program computes the voltages and currents induced by an incident plane electro-magnetic wave on the conductors or in the loads of a lossless transmission line made up of 11 conductors or less. The solution is provided both in the frequency and time domains. The program accepts arbitrary angles of incidence, transmission-line length, and resistive terminations. The Thevenin equivalent lumped-parameter method is described for use of NLINE with non-linear loads. Computational agreement with experimental data is demonstrated. A complete FORTRAN program listing is included. Author (GRA)

N77-31364# Naval Surface Weapons Center, White Oak, Md.
HUGGIN'S SCANNED RADIOMETER
A. D. Krall and J. G. Schofield Feb. 1977 30 p
(WF32343XXX)
(AD-A040835; NSWC/WOL/TR-77-33) Avail: NTIS HC A03/MF A01 CSCL 09/5

Application of Huggins Scanning Technique to a Millimeter Radiometer. Noise calculations are made from the antenna terminals to the IF. A method of providing wide instantaneous bandwidth is discussed, along with a method of beam control. Author (GRA)

N77-31365# Harris Corp., Melbourne, Fla. Electronic Systems Div.
STUDY OF ALTERNATIVE TECHNIQUES FOR COMMUNICATION NETWORK TIMING/SYNCHRONIZATION Final Report, Jan. 1976 - Mar. 1977
23 Mar. 1977 309 p refs
(Contract DCA100-76-R-0028)
(AD-A041004) Avail: NTIS HC A14/MF A01 CSCL 17/2

In digital point-to-point communications, it is only necessary that the receiver be correctly synchronized to the received bit stream and it is not necessary to synchronize the transmitters. However, in a large digital communications network where the signals remain in digital form through time division multiplexers and/or switches, each bit must be available at the correct time to fill its assigned time slot. This is a report on the study of this problem. It evaluates the requirements for a timing subsystem for the future DCS, gives rationale for those characteristics of a DCS timing subsystem which will best meet the needs of the DoD and the U.S. Government. The conclusions of the study state, 'The results of both the analysis and simulation efforts have led to the recommendation of time reference distribution as the technique to employ at the major nodes of the switched digital Defense Communications System.' The study also recommends that the master-slave technique be used at lower level nodes. Author (GRA)

N77-31366# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
AN I. F. SIGNAL SIMULATOR FOR FM RANGING SYSTEMS
Marion C. Barlett and Raymond C. Johnson Jun. 1977 21 p refs
(Contract DAAG39-77-C-0045; DA Proj. 1L6-62616-AH-77)
(AD-A041586; HDL-CR-77-045-1) Avail: NTIS CSCL 17/2

An intermediate frequency signal simulator (IFSS) which is useful for testing many FM ranging systems is described. The IFSS can be constructed using readily available laboratory test equipment. Target delay time tau and Doppler frequency can be set manually for static circuit tests or varied automatically to simulate dynamic target approaches. The IFSS also provides the capability for generating dynamic signals for measuring the ambiguous range responses of a system. GRA

N77-31367# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A TECHNIQUE FOR DETERMINING RADAR TARGET SCINTILLATION (GLINT) Final Technical Report, 1 Jan. 1975 - 31 Jul. 1976
D. G. Bodnar May 1977 143 p refs
(Contract F33615-75-C-1069; AF Proj. 7633)
(AD-A041493; GIT-A-1704; AFAL-TR-76-266) Avail: NTIS HC A07/MF A01 CSCL 17/9

A technique is described for obtaining near-zone as well as far-zone GLINT data on aerospace targets based on near-field measurements of the target. A modal expansion in terms of plane wave functions is used to represent the fields scattered

by the target. A similar representation is made for the tracker antenna of interest based on measurements of its near fields. The antenna and scattering characteristics are combined using equations presented in the report to predict the received signal at virtually any distance from the target between the measurement plane and infinity. The technique is demonstrated on an F-105 model aircraft and a single plane monopulse tracking antenna at X-band. Excellent agreement between measured and predicted error signal is presented for various fly-bys of the monopulse antenna past the target. Also presented is a new characterization technique for near-field probes which simplifies the process of obtaining their plane wave spectrum.
Author (GRA)

N77-31368# Naval Ocean Systems Center, San Diego, Calif.
AN/PRC-56 HELMET RADIO SET UPGRADING. RECOMMENDED MODIFICATIONS REQUIRE MINIMAL RESOURCES BUT PROMISE CONSIDERABLE IMPROVEMENT IN RELIABILITY OPERABILITY, AND LOGISTICS SUPPORT Technical Document, Jul. 1976 - Apr. 1977
T. H. Townsend 15 May 1977 29 p refs
(AD-A041190; NOSC/TD-105) Avail: NTIS HC A03/MF A01 CSCL 17/2

A field change, printed as an appendix to this document, is recommended as the means of accomplishment for most of the corrective actions suggested here. It includes new on/off and push-to-talk switches, a microphone with windscreen, a longer microphone boom, an improved squelch adjustment, improved-reliability parts, more-stable tuning, and sidetone. Action by depot and navelex is also recommended. Author (GRA)

N77-31369# Lehigh Univ., Bethlehem, Pa. Dept. of Industrial Engineering.
EXTENSIONS OF STOCHASTIC NETWORK THEORY TO FACILITATE THE DEVELOPMENT OF MOE'S FOR COMMUNICATION SYSTEMS Final Report
Gary E. Whitehouse and John J. Fagan 1977 123 p refs
(Contract N00014-76-C-0900)
(AD-A041314; IE-77-OR-1) Avail: NTIS MF A01 CSCL 17/2

Recent advances in computer-communications technology have given rise to the development of large, complex data communication networks. The high cost of developing and operating these networks have prompted researchers to search for appropriate measures of network performance. Techniques must be made available to analyze network design alternatives in terms of these performance measures. Researchers, however, have found it particularly difficult to develop analytical techniques that will effectively account for all of the complexities inherent in modern computer-communication networks. Consequently, many analysts have turned to simulation as an alternative. This report shows how certain simulation techniques can be used to estimate performance measures for various types of communication networks. Communication networks may be conveniently classified into three types as follows: (1) Circuit-Switched, (2) Message-Switched, and (3) Packet-Switched. GRA

N77-31370# Army Electronics Command, Fort Monmouth, N.J. Combat Surveillance and Target Acquisition Lab.
DATA LINK VALIDATION PROGRAM Final Report, 1 Apr. 1976 - 28 Feb. 1977
Donald J. Blue, Robert G. Witham, and Steven A. Bleier May 1977 103 p
(AD-A041236; ECOM-4500) Avail: NTIS HC A06/MF A01 CSCL 17/2

The primary purpose of this investigation was to determine the effects of delivery system emplacement inaccuracies and relay antenna height on radio frequency (RF) sensor data link performance. The results indicate that, for this type of data transmission system, the effects of emplacement errors from a selected or optimum point (OP) was dependent on whether radio line-of-sight exists between the selected or 'optimum' sites. If RF line-of-sight was at least partially available, increasing the antenna height to 30 feet normally resulted in a reliable link. Throughout these tests, reliable sensor data links were established in hilly terrain wherever firm RF line-of-sight conditions existed. The tests demonstrated that reliable sensor-to-monitor links operated in hilly terrain can be established for distances up to 21 Km, and that reliable sensor-to-monitor links using multiple relays can be established for distances up to 76 Km. When operating in flat terrain, the tests demonstrated that the sensor-to-monitor data links performed reliably, even if RF line-of-sight did not exist for distances up to 29 Km. When the standard sensor antenna is used as opposed to the low loss antenna, the reliability of the link is degraded significantly except for distances of about 9.5 to 16.4 Km. GRA

N77-31371# Naval Research Lab., Washington, D. C.
INTERACTION OF ELECTROMAGNETIC WAVES WITH A MOVING IONIZATION FRONT Interim Report
Martin Lampe and Edward Ott Jun. 1977 59 p refs
(AD-A041177; NRL-MR-3531) Avail: NTIS HC A04/MF A01 CSCL 20/9

This paper considers the problem of an electromagnetic wave packet incident on a relativistically moving plane ionization or recombination front separating a stationary neutral gas region from a stationary plasma region. The frequency of the reflected wave packet is found to obey the usual double Doppler shift relation. However, the reflection coefficients and the physics can differ significantly from the case of reflection from moving material objects. The ratio of the energy in the incident wave packet is shown to be at most (i.e. for the overdense case $\text{omega(i)}^*/\text{omega(r)}^*$ for the ionization front omega(i)^* is less than omega(r)^*, and $\text{omega(r)}^*/\text{omega(i)}^*$ for the recombination front omega(i)^* is greater than omega(r)^*, where omega(i)^* and omega(r)^* are the incident and reflected wave frequencies in the laboratory frame. These results have important implications for the production of submillimeter wavelength pulses by upshifted reflection from a relativistically moving ionization front. Author (GRA)

N77-31372# Naval Research Lab., Washington, D. C.
STATISTICAL CORRELATION DISTANCE FOR PLATFORM-TO-PLATFORM RADAR INTEGRATION Interim Report
B. H. Cantrell 18 May 1977 8 p refs
(AD-A041429; NRL-8123) Avail: NTIS HC A02/MF A01 CSCL 17/9

The concept of using a statistical distance for associating target detections and tracks and for track maneuver detection has been used for sometime in tracking with search radars. The statistic normally used with collocated radars was derived using fundamental hypothesis-testing techniques. A parallel development using predicted positions as well as measured positions was performed, and a new statistical distance measure was obtained which would probably be of more use in integrating data from noncollocated sites. In general the form is quite complicated, but if the radar measurements are unbiased, if no bias exists between different radars, and if the predicted position is not corrupted by target maneuvers or previously missassigned detections, the statistical distance becomes easy to implement.
Author (GRA)

N77-31373# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
ANALYSIS OF A MONOPULSE RADAR
Franklin M. Waddle Nov. 1976 44 p refs
(AD-A041379; RG-77-6) Avail: NTIS HC A03/MF A01 CSCL 17/9

A simplified monopulse radar is analyzed and expressions for the outputs of the error detectors are derived with the assumption of no interfering signals being present. Interfering signals are then added to the radar input. A brief look is also taken at a radar antenna control system. Author (GRA)

N77-31374# Utah Univ., Salt Lake City. Dept. of Computer Science.
NOISE SUPPRESSION METHODS FOR ROBUST SPEECH PROCESSING Semiannual Technical Report, 1 Oct. 1976 - 31 Mar. 1977
Steven F. Boll Apr. 1977 75 p refs
(Contract N00173-77-C-0041; ARPA Order 3301)
(AD-A041337; UTEC-CSC-77-090) Avail: NTIS HC A04/MF A01 CSCL 17/2

Robust speech processing in practical operating environments requires effective environmental and processor noise suppression. This report describes the technical findings and accomplishments during this reporting period for the research program funded to

develop real time, compressed speech analysis-synthesis algorithms whose performance is invariant under signal contamination. Fulfillment of this requirement is necessary to insure reliable secure compressed speech transmission within realistic military command and control environments. Overall contributions resulting from this research program include the understanding of how environmental noise degrades narrow band, coded speech, development of appropriate real time noise suppression algorithms, and development of speech parameter identification methods that consider signal contamination as a fundamental element in the estimation process. Through the appropriate integration of developed noise suppression-parameter identification algorithms, specifications for robust speech processing algorithms will be provided. Author (GRA)

N77-31375# Army Construction Engineering Research Lab., Champaign, Ill.

RADIO FREQUENCY SHIELDING TESTS OF SYSTEM TECHNOLOGY TEST FACILITY AT MECK ISLAND, MARSHALL ISLANDS Final Report, 16 Aug. - 15 Oct. 1976

P. H. Nielsen Jun. 1977 121 p
(AD-A041450; CERL-SR-E-107) Avail: NTIS HC A06/MF A01 CSCL 09/1

This report presents the results of tests and inspections performed to verify the shielding integrity of the newly constructed Systems Technology Test Facility (STTF) on Meck Island, Kwajalein Atoll, Marshall Islands. Recommendations for improvement of the structure's effectiveness, including suggested maintenance techniques and recommendations for additional testing, are presented. The report also evaluates the radio frequency (RF) shielded enclosure leak detection (sniffer) test technique for determining the shielding performance of a structure. Author (GRA)

N77-31376# Ohio State Univ., Columbus. ElectroScience Lab.

A GTD ANALYSIS OF THE RADIATION FROM SLOTS IN PLANAR AND CYLINDRICAL PERFECTLY-CONDUCTING STRUCTURES WITH A SURFACE IMPEDANCE PATCH Final Report, 15 Mar. 1976 - 6 Jan. 1977

P. H. Pathak Feb. 1977 75 p refs
(Contract F19628-76-C-0154)
(AD-A041974; ESL-4396-2; RADC-TR-77-156) Avail: NTIS HC A04/MF A01 CSCL 09/5

A theoretical approach based on the geometrical theory of diffraction (GTD) is employed to analyze the fields radiated by thin slots in perfectly-conducting infinite planar, and electrically large circular cylindrical structures which are covered with an impedance surface patch. The solution to these antenna problems is built up from the solutions to several, appropriate canonical problems. The total field radiated by the slot is composed of the fields of rays which emanate from the slot to the observation point via points of diffraction on the surface, in addition to the direct ray path. The type of impedance surface chosen is such that the slot excites a bound surface wave mode on the flat impedance surface patch for the planar case, whereas it excites an Elliot type mode on the curved impedance patch for the circular cylinder case. The GTD solution not only imparts a physical insight into the radiation mechanisms involved, but it is also efficient for numerical calculations. Some numerical results based on this initial GTD analysis are presented, and are seen to agree well with the results obtained by other approaches. Author (GRA)

N77-31377# Lincoln Lab., Mass. Inst. of Tech., Lexington.

BEHAVIOR OF A LINK IN A PVC NETWORK

Alan G. Nemeth 7 Dec. 1976 23 p refs
(Contract F19628-76-C-0002)
(AD-A036370; TN-1976-45; ESD-TR-76-338) Avail: NTIS HC A02/MF A01 CSCL 17/2

The purpose of the note is to discuss the properties of a single link in a Packetized Virtual Circuit (PVC) network under a load consisting of a combination of voice and data traffic. Such properties as the mean waiting time for data packets, overall line utilization, and required amount of buffering are investigated as a function of the percentage of the channel dedicated to voice. A combination of simulation and analytic techniques have been used to obtain the results described here. These results indicate the possibility of achieving line utilizations of up to 98%, within quite practical values of buffering, and packet delay. GRA

N77-31378# Science Applications, Inc., Berkeley, Calif.

CALCULATION OF THE EQUIVALENT CAPACITANCE OF A RIB NEAR A SINGLE-WIRE TRANSMISSION Final Report

Shimon Coen, Tom K. Liu, and Frederick M. Tesche Jun. 1977 35 p refs
(Contract F29601-76-C-0125)
(AD-A041446; AFWL-TR-77-60) Avail: NTIS HC A03/MF A01 CSCL 09/1

The effect of a rib lying on a ground plane on a single wire transmission line can be represented by a lumped capacitance. In this paper, the capacitance is evaluated by solving a set of coupled integral equations. Parametric studies are carried out and the results are presented in graphical form. Author (GRA)

N77-31379# Brookhaven National Lab., Upton, N. Y.

EFFECTIVE COUPLING IMPEDANCE AND THE MICROWAVE INSTABILITY

E. Messerschmid and M. Month 1976 10 p
(Contract EY-76-C-02-0016)
(BNL-22236) Avail: NTIS HC A02/MF A01

Observations on the growth of beam density fluctuations demonstrate the existence of longitudinal instabilities of individual bunches at very high frequencies. The dependence of the threshold impedance and growth rate on the local characteristics of a bunch was qualitatively confirmed by numerical simulation of a particle bunch interacting with high frequency resonators of low quality factor (i.e., low Q). However, when the quality factor of the resonant objects was changed, while keeping the frequency of the resonators fixed, a very strong impact on the results was observed, thus indicating that the simple picture of local bunch segments behaving independently is incomplete. A theory for the fast bunch blow-up is presented. The predictions of this theory are consistent with both computational experimental observations. ERA

N77-31380# World Meteorological Organization, Geneva (Switzerland).

ON THE AUTOMATION OF METEOROLOGICAL TELECOMMUNICATION CENTRES

1977 106 p
(WMO-468; ISBN-92-63-10468-9) Avail: NTIS HC A06/MF A01; WMO, Geneva

To assist those contemplating the introduction of automation at their telecommunication center, the guide covers the following aspects: formulation of user requirements; project planning, definition, and control; system design concepts; tendering and contract action; production phase; acceptance testing and subsequent user commissioning; accommodation, installation, and maintenance; test equipment; possible technological trends in automated telecommunication system. ESA

N77-31381# European Space Agency, Paris (France).

VERNIER BEAM STEERING BY FEED SYSTEM DISPLACEMENT OF A SATELLITE REFLECTOR ANTENNA

R. Bredow and G. Schindler Jul. 1977 112 p refs Transl. into ENGLISH of 'Feinnachfuehrung der Strahlungscharakteristik von Satellitenbord-Reflektorantennen durch Mech. Bewegung des Speisesystems', Siemens A. G., Munich Report BMFT-FB-W-76-21, Dec. 1976 Original report in GERMAN previously announced as N77-23330 Original GERMAN report available from ZLDI, Munich DM 27.55
(ESA-TT-394; BMFT-FB-W-76-21) Avail: NTIS HC A06/MF A01

Several possibilities of Vernier beam steering by displacement of the feed system for the transmit antenna of a TV broadcasting satellite were investigated. The influence of antenna parameters such as aperture shape, illumination function, and focal length was examined by means of the aperture field method. Startin with the center fed prime focus reflector antenna (calculation by means of current distribution method) the electrical properties of the offset fed prime focus reflector and the Cassegrain fed reflector were derived and demonstrated in experiment. Lateral feed displacement and tilting of the subreflector turned out to

be optimal for the prime fed and Cassegrain fed reflector, respectively. The problems of a beam steering mechanism are discussed and possibilities for realization are shown.
Author (ESA)

N77-31382# Scott Research Labs., Inc., Plumsteadville, Pa.
THE ANALYSIS OF PROPAGATION ON PERIODICALLY SLOTTED COAXIAL CABLE ABOVE LOSSY GROUND Final Report, 1 Jan. - 30 Nov. 1976
A. Hessel, S. Choudhary, L. B. Felsen, and S. Y. Shin Feb. 1977 48 p refs
(Contract F19628-76-C-0133)
(AD-A040044; POLY-EE/EP-77-025; RADC-TR-77-85) Avail: NTIS HC A03/MF A01 CSCL 20/14

After formulation of an integral equation and of the dispersion relation for a periodically slotted coaxial cable above and parallel to the air-lossy ground planar interface, the report addresses the evaluation of the exterior dyadic Green's function in a unit cell. The latter constitutes the heretofore not available in the literature kernel of the integral equation. The problem is reduced to an evaluation of the field of electric and magnetic multipole phased line sources above a lossy ground. The analysis of the various relevant integrals is carried out either in terms of an asymptotic expansion or rigorously by function theoretical methods. Author (GRA)

N77-31383# IIT Research Inst., Chicago, Ill.
EMP PREFERRED TEST PROCEDURES. REVISION
J. E. Bridges, W. C. Wells, L. C. Peach, W. C. Emberson, and L. B. Townsend Feb. 1977 58 p
(Contracts DNA001-75-C-0201; DNA001-73-C-0149)
(AD-A039768; IITRI-E6230-Rev) Avail: NTIS HC A04/MF A01 CSCL 18/6

IIT Research Institute has developed EMP Preferred Test Procedures for selected electronic components. This is part of a continuing program to formulate and recommend procedures by which EMP test data may be obtained and reported. In this connection, it is important to realize what these preferred procedures are and what they are not. They are a formal recognition of good practices and methods based on sound physical principles which can lead to useful EMP data. They provide a means of communicating useful information among workers in a large multidisciplined technology. These preferred procedures are not necessarily cook-book simplifications and are not intended to be a MIL-SPEC or a panacea for designers of hardened systems. The EMP Preferred Test Procedures require some experience and intelligence on the part of the experimenter. GRA

N77-31384# Mississippi State Univ., Mississippi State. Engineering Industrial Research Station.
A STUDY OF THE CHARGE AND CURRENT INDUCED ON AN AIRCRAFT IN AN EMP SIMULATOR FACILITY. PART 1: THE FORMULATION. PART 2: THE SINGULARITY EXPANSION METHOD. PART 3: THE NUMERICAL RESULTS Final Report
Clayborne D. Taylor, Keh-Tong Chen, Terry T. Crow, and Murali Kumbale Dec. 1976 168 p refs
(Grant AF-AFOSR-2961-76)
(AD-A039507; AFOSR-77-0636TR) Avail: NTIS HC A08/MF A01 CSCL 18/3

A study of the aircraft skin current and charge is made for an aircraft under the illumination of the electromagnetic field produced by a nuclear EMP simulator. This work is motivated by the need to relate the response of an aircraft in the EMP simulator to the response of an aircraft under actual EMP illumination. The analysis toward a specific EMP simulator at Kirtland AFB, New Mexico; however, the methodology presented is applicable to other types of simulator facilities. Author (GRA)

N77-31385# Naval Research Lab., Washington, D. C.
MODIFICATIONS TO AND PRELIMINARY RESULTS FOR THE ADIT SYSTEM Interim Report
G. V. Trunk, J. D. Wilson, B. H. Cantrell, J. J. Alter, and F. D. Queen 19 Apr. 1977 46 p refs
(AD-A039799; NRL-8091) Avail: NTIS HC A03/MF A01 CSCL 17/9

The basic system philosophy of the automatic detection and integrated tracking (ADIT) system has been reviewed. The only change to the detection system has been the addition of a merging circuit to reduce target splits. The tracking program has been modified to improve tracking performance. Included in the new tracking program are dual clutter map, new tracking filter, new correlation logic based on track quality, automatic bias correlation between radars, sector censoring capability, and a new program control. Analysis of recorded data showed that the detection system works as anticipated, detecting the targets and limiting the false alarms to a manageable number. Analysis of tracking data yielded the following conclusions: (a) detections, not tracks, should be merged, (b) tracks should be initiated with at least three detections, (c) a dual clutter map should be used, (d) the SPS-12 and SPS-39 supply an equal number of detections, (e) bias correction procedures work when the azimuth bias is less than the normal track correlation region, (f) typical errors between measured and predicted positions are 0.20 n. mi. and 0.5 deg., and (g) the turn detector enables the tracking filter to follow maneuvering targets. Author (GRA)

N77-31386# Naval Research Lab., Washington, D. C.
SURVEILLANCE RADAR SYSTEMS EVALUATION MODEL (SURSEM) HANDBOOK Final Report
David J. Kaplan, Alex Grindlay, and Laura Davis 14 Jan. 1977 168 p
(AD-A039841; NRL-8037) Avail: NTIS HC A08/MF A01 CSCL 17/9

The Surveillance Radar Systems Evaluation Model (SURSEM) is a user-oriented computer model designed to generate radar single-scan and cumulative probability of detection values as a function of target range and orientation within a specified environment. A model overview, instructions for the potential SURSEM user, and a detailed description of each SURSEM subroutine have been developed as well as a FORTRAN program listing and a description of MTIMOD, a moving target indicator signal-processing subprogram to be integrated into SURSEM. Author (GRA)

N77-31387# Naval Research Lab., Washington, D. C.
DATA-REDUCTION TECHNIQUES FOR MULTIPLE-PLATFORM RADAR INTEGRATION Interim Report
Ben H. Cantrell 20 Apr. 1977 7 p refs
(AD-A039621; NRL-8120) Avail: NTIS HC A02/MF A01 CSCL 17/9

A means of sending only the best raw detections from radars to update a track is considered. A specific error-filtering concept and method of implementation are introduced. The method depends on comparing the last three raw detections with the current raw detection under test to determine if it will significantly aid the track. In addition the method does not require any additional information be sent over the channel for its implementation. Finally, track updating using range and range rate from at least three noncolocated radars is considered. This method would require little information to be transmitted on the channel, but it is useful only when certain criteria are met. Combinations of both methods may provide the best solution. Author (GRA)

N77-31388# Naval Research Lab., Washington, D. C.
A METHOD FOR COMPUTING VERTICAL-PLANE COVERAGE DIAGRAMS FOR FREQUENCY AGILE PULSE RADAR SYSTEMS
W. H. Harper and P. N. Marinos Apr. 1977 53 p refs
(AD-A040081; NRL-MR-3475) Avail: NTIS HC A04/MF A01 CSCL 17/9

A method for obtaining computer plots of vertical-plane coverage diagrams (i.e., range-height-angle charts) for frequency agile pulse radar systems is presented. The approach is based on well-known monochromatic radar detection calculations which are here extended to cover the frequency agile case.
Author (GRA)

N77-31389# TDR, Inc., Los Angeles, Calif.
FOUNDATION OF THE MAGNETIC FIELD INTEGRAL EQUATION CODE FOR THE CALCULATION OF THE ELECTROMAGNETIC PULSE EXTERNAL INTERACTION WITH AIRCRAFT Final Report
Maurice I. Sancer, Scott Siegel, and A. D. Varvatsis Apr. 1977 147 p refs

(Contract F29601-75-C-0067)
(AD-A039953; AFWL-TR-76-279) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report presents the equations that are programmed along with their derivations and the underlying theory. The code determines the current density and charge density induced on a model of an aircraft. The equations that are programmed result from patch zoning the aircraft model in order to obtain a solution to the frequency domain representation of the magnetic field intergral equation. The intent is to obtain solutions for a continuous spectrum that includes the low and resonant range of frequencies corresponding to the bulk of the energy in a typical EMP spectrum. Author (GRA)

N77-31390# Kansas Univ. Center for Research, Inc., Lawrence.
VIDEO BANDWIDTH COMPRESSION Final Report, Dec. 1973 - Dec. 1975
Norman C. Griswold and Robert M. Haralick Feb. 1977 246 p refs
(Contract F33615-74-C-1093)
(AD-A039761; Rept-257-4; AFAL-TR-76-102) Avail: NTIS HC A11/MF A01 CSCL 17/2

This project report summarizes the bandwidth compression research activities performed by the University of Kansas under contract number F33-615-74-R-1093 with the Air Force Avionics Laboratory at Wright Patterson Air Force Base, Ohio. The primary purpose of this study is to investigate the feasibility of video bandwidth compression in the order of 50:1. This compression was simulated using imagery digitized to 64 grey levels (6 bits). This task was accomplished by three steps. These steps are: transform compression, frame rate reduction, and Differential Pulse Code Modulation (DPCM). Since the transform compression scheme is vital to the success of this project, major emphasis was placed on this area. Results indicate that a 50:1 compression is feasible and that the best transforms to be utilized in a hybrid manner with DPCM is the Discrete Cosine. Additional research developments led to a fast implementation of the Karhunen Loeve transform which is optimum under root mean square error criteria. Comparisons of other fast transform performance is made as well as an optimum bit coding scheme. Author (GRA)

N77-31391# Naval Postgraduate School, Monterey, Calif.
STATISTICAL ASPECTS OF THE AN/TPQ-27 PSVT DESIGN
Donald R. Barr Mar. 1977 34 p refs
(AD-A039238; NPS55-77-13) Avail: NTIS HC A03/MF A01 CSCL 19/5

The AN/TPQ-27 currently under development for the Marine Corps by NAVELEX is scheduled to undergo a test series known as the PSVT. A primary goal of the PSVT is to determine whether the system is operating with acceptable accuracy. Several sequential and fixed sample size tests are discussed which could be used for this purpose. Several aspects of the statistical design of the experiment are discussed, and recommendations regarding secondary analysis are made. A method of reducing sample size requirements for the nonparametric accuracy tests is presented. Author (GRA)

N77-31392# Naval Research Lab., Washington, D. C.
SQUID ELF RECEIVING ANTENNA FOR SUBMARINE APPLICATIONS Final Report
Robert J. Dinger, John R. Davis, Joseph A. Goldstein, William D. Meyers, and Martin Nisenoff 25 May 1977 51 p refs
(AD-A040738; NRL-8118) Avail: NTIS HC A04/MF A01 CSCL 09/5

An ELF receiver using a triaxial array of superconducting quantum interference devices (SQUIDs) can provide an omnidirectional receiving capability unobtainable with conventional ELF antennas. The ELF SQUID receiver development program has undertaken (a) achievement of a prototype SQUID device with sufficient sensitivity, dynamic range, and linearity; (b) determination of the motion spectrum for a candidate receiver platform; (c) design of a motion processing technique to remove residual motion noise; and (d) provision of a suitable cryogenic environment. Two prototype SQUID antennas, one using point-contact sensors and the other using thin-film sensors, were procured and tested. GRA

N77-31393# Office of Naval Research, London (England).
COMMUNICATION ENGINEERING IN FINLAND
Nelson M. Blachman 29 Mar. 1977 17 p
(AD-A040264; ONRL-R-4-77) Avail: NTIS HC A02/MF A01 CSCL 09/3

The principal institution for electrical engineering education in Finland is the Helsinki University of Technology. The Technical Research Center of Finland is the leading organization in engineering research, and Nokia Electronics is the leading manufacturer of electronic equipment. This report discusses their activities--particularly in the field of communication engineering--and includes some remarks on the work going on elsewhere as well as on the general historical background. Author (GRA)

N77-31394# Speech Communications Research Lab., Inc., Santa Barbara, Calif.
ACOUSTIC/LINGUISTIC ASPECTS OF AUTOMATIC SPEECH RECOGNITION Interim Report, 1 Jan. - 31 Dec. 1976
David J. Broad and Larry L. Pfeifer 18 Apr. 1977 14 p
(Contract F44620-74-C-0034)
(AD-A040332; AFOSR-77-0631TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

The following work was accomplished during this contract year: (1) Implementation of programs and procedures for storing labels which contain descriptive information about speech events, thereby permitting sorting and retrieval of speech sounds based upon certain qualities or characteristics; (2) Implementation of an automatic procedure for screening data for the purpose of locating potentially erroneous samples in a large data base; (3) Formulation of an automatic boundary detection algorithm which is useful for locating the boundaries between speech sounds; and (4) Formulation of an automatic steady-state detection algorithm which locates and labels the most stable interval of a speech sound. GRA

N77-31395# Texas Instruments, Inc., Dallas.
REMOTE TERMINAL SPEAKER VERIFICATION Final Technical Report, Jan. 1976 - Jan. 1977
Bruce G. Secrest and Ramon E. Helms May 1977 74 p refs
(Contract F30602-76-C-0112)
(AD-A040827; TI-TR-08-77-07; RADC-TR-77-169) Avail: NTIS HC A04/MF A01 CSCL 09/4

A study was conducted to develop a speaker verification system for use over a degraded channel such as a telephone line. A test of the current speaker verification technology was performed on a set of data which had been processed through the RADC Digital Communications Experiment facility (DICEF) to simulate a telephone channel. The simulated channel introduced an amplitude distortion, phase delay, and noise onto the analog data set. The noise did not present any particular problem other than to raise the spectral errors of both the true speakers and the impostors, and the phase delay was also not a factor. The amplitude distortion was found to cause problems with time registration of the phrases and to result in an overall loss of information for speaker discrimination. To compensate the speaker verification system for these problems, a band-limited spectrum corresponding to the average band-pass characteristic of a telephone line was used for time registration, and the channel resistant pitch-period was added as an additional attribute for speaker discrimination. GRA

N77-31396# Harry Diamond Labs., Adelphi, Md.
TRANSIENT RESPONSE OF A LOG-PERIODIC ANTENNA BASED ON BROAD-BAND CONTINUOUS-WAVE MEASUREMENTS
Werner J. Stark Apr. 1977 30 p
(AD-A040512; HDL-TR-1792) Avail: NTIS HC A03/MF A01 CSCL 09/5

The broad-band characteristics of a very-high-frequency log-periodic antenna were determined and used to compute the response of this antenna to a transient incident electromagnetic fields. The antenna characteristics were obtained from broad-band continuous-wave (CW) measurements, and the transient response was computed from Fourier analysis of the CW data. The computed transient response showed good agreement with the measured transient response. An approximate theoretical solution was developed based on these measurements. Author (GRA)

N77-31397# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DIGITAL TRANSMISSION EVALUATION PROJECT DR8A TEST
James E. Hamant, O. P. Connell, and Henry S. Walczyklink 30 Apr. 1977 49 p
(AD-A040234; CCC-CED-77-DTEP-012) Avail: NTIS HC A03/MF A01 CSCL 17/2

The Avantek DR8A radio was tested in back-to-back configuration and an actual link configuration to determine transfer parameters and to refine standard test techniques. The radio operates at a baseband rate of 12.5526 Mb/s (192 voice channels) in a 7 MHz bandwidth in the 8GHz band. The modulation technique is quadrature phase partial response (QPR). BER vs RSL characteristics are displayed as the primary mode of equipment evaluation. Carrier-to-interference data and diversity switching error data are presented. The power spectrum is displayed showing 99% power bandwidth points and masks for the FCC emission limitations. The mean BER vs RSL curve is displayed approximately 4 db from the theoretical, with about a 3.5 db maximum variation among transmitter-receiver combinations. The 99% power bandwidth is 6 MHz, and application of the mask indicates compliance with the FCC digital limitations, after assumptions. C/I results show that the 18 db ratio is the lowest tolerable, with a mean BER plateau of 0.0001, at higher RSL's. Receiver diversity switching results confirm errorless operation. Link bit error rate unavailability is quantified graphically. Increased amplification of transmitted signal was possible to 5.0 watts without serious degradation. Author (GRA)

N77-31398# Threshold Technology, Inc., Delran, N. J.
VOICE INPUT CODE IDENTIFIER VICI Final Technical Report
Phillip B. Scott Jun. 1977 68 p refs
(Contract F30602-75-C-0111)
(AD-A040994; RADC-TR-77-190) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the development, operation and performance characteristics of an improved Advanced Development Model of a Voice Input Code Identifier (VICI). The VICI is an isolated word recognition system capable of recognizing the English digits and four control words, CANCEL, ERASE, VERIFY and TERMINATE. The improved VICI system is based upon equipment previously developed under Contract F30602-74-C-0171. This original VICI system was intended for use by male talkers only and required wide bandwidth speech data input. The advanced development model is capable of operation with input speech which has been limited to telephone bandwidth. It will accept digits and control words as spoken by either male or female talkers. No training of the system by a speaker is necessary. By the use of an alpha-numeric output display, a speaker using the system can verify that each digit spoken into the system was correctly recognized. Errors can be corrected through the use of the control words. In addition, the system can detect and correct many single digit errors which occur within six digit code groups. This error correction algorithm uses check digits which are included in the code groups to detect errors. The system then corrects the errors when possible or requests a reentry of the data by the talker. A speaker dependent software package also was developed which provides for the recognition of up to 200 words. GRA

N77-31399# Naval Ocean Systems Center, San Diego, Calif.
SPATIAL DIVERSITY CHARACTERISTICS OF EQUATORIAL SCINTILLATION. UHF AND L-BAND SATCOM TESTS AT GUAM, JUL. - DEC. 1976 Final Report, Jan. 1975 - Mar. 1977
M. R. Paulson and R. U. F. Hopkins 2 May 1977 68 p refs
(AD-A040628; NOSC/TR-113) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the results of space diversity tests conducted at Guam in the summer and fall of 1976 to evaluate the utility of this technique for mitigating the corrupting effects of equatorial scintillation on SATCOM links. Two wavelengths were employed for different systems evaluation; one at UHF for Fleet SATCOM and one at L-Band for the Global Positioning System (GPS). Down-link results at UHF showed that error rates approaching 50 percent can be completely eliminated by use of space diversity. Various statistical representations of data obtained three diversity spacings enabled thorough analysis required to investigate optimization of the diversity configuration. L-Band scintillation, though less intense than a UHF, did occur at levels that may affect the performance of the GPS. Estimates of reduced system margins at both the L1 and L2 frequencies used in the GPS are presented. Phase measurements at UHF are shown and a discussion relative to its effects on both systems is presented. Considered in the discussion is low-angle fading which is predicted to be of concern relative to the Indian Ocean GAPFILLER. Author (GRA)

N77-31400# Rome Air Development Center, Griffiss AFB, N.Y.
STUDIES OF ELECTRON INTERACTIONS WITH COMMUNICATIONS MATERIALS Final Report, Jul. 1970 - Sep. 1976
J. C. Ashley and M. W. Williams Feb. 1977 119 p refs
(AD-A040937; RADC-TR-77-74) Avail: NTIS HC A06/MF A01 CSCL 07/5

This report summarizes various theoretical and experimental studies designed to yield information on electron interactions with various communications materials. Experimental electron slowing-down spectra have been obtained for Si and for Al2O3 and various theoretical models proposed to account for these spectra. Attempts to measure electron attenuation lengths for photo-excited electrons in carbon, polystyrene, and gold over a range of photon energies from 20 to 64 eV, are described. A critique of photoelectric yield methods for measuring electron attenuation lengths stresses the difficulty of obtaining small values of this quantity to an accuracy of even 10%. Theoretical models combined with experimental data have resulted in tabulations of mean free path, energy loss, energy straggling, range, and range straggling for electrons in Al, Al2O3, Si, SiO2, Ni, Cu, Ag, Au, Ge, and GaAs. Author (GRA)

N77-31401# General Electric Co., Schenectady, N.Y.
APPLICATION OF SATELLITE COMMUNICATION AND POSITION FIXING TECHNIQUES TO LAND MOBILE SYSTEMS
Axel F. Brisken, Richard L. Frey, and Roy E. Anderson Apr. 1977 356 p refs Sponsored in part by Immigration and Naturalization Service, Wash., D. C.
(PB-267019/8; SRD-77-001) Avail: NTIS HC A16/MF A01 CSCL 17B

A series of experiments were conducted with the NASA ATS-3 and ATS-1 satellites. The experiments were designed to evaluate the performance of a satellite based mobile-to-base communication, tracking and data relay concept. Data were gathered as a test vehicle travelled across the U.S. The results of the project validated the potential application of geostationary satellite technology into law enforcement operations. GRA

N77-31402# Li (George S.), Rockville, Md.
ANALYSIS OF SUBMARINE CABLE AND COMMUNICATION SATELLITE SYSTEMS RELIABILITIES
George S. Li Apr. 1977 33 p
(Contract COM-OT-16791)
(PB-266973/7; OT-CR-77-5) Avail: NTIS HC A03/MF A01 CSCL 17B

The performance of AT&T's overseas message telephone circuits for the years 1970-1975 was the basis for ana analysis of the reliability of submarine cables and communication satellite systems. Data presented in 24 tables is devided into three categories: (1) over cable and satellite system outage statistics for each of the six years and the six year average, (2) detailed cable system outages for each of the six years showing the causes of the outages, the means of restorations, and a summary of failures as a function of particular cable system for the six year period and (3) detailed satellite system outages for each of the six years showing the causes of outages for the six year period. GRA

N77-31403# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
CONFIDENCE LIMITS FOR DIGITAL ERROR RATES FROM DEPENDENT TRANSMISSIONS
Edwin L. Crow and Martin J. Miles Mar. 1977 156 p refs
(PB-267777/1; OTR-77-118) Avail: NTIS HC A08/MF A01 CSCL 09D

Approximate confidence limits for error rates (probabilities of an error) of digital communication systems are derived under the assumptions that the sample is large, the error rate is constant and the dependence between transmissions is governed by a stationary first order Markov chain model. Five different approximations are given: (1) normal distribution, (2) Edgeworth two term and (3) four-term; (4) Pearson system; and (5) modified Poisson-Anderson-Burstein. Results by Gabriel and by Klotz are used. The limits are compared with Ladd's small sample limits and illustrated on telephone data. Methods for testing the validity of the model are described. A computer program for applying the limits is presented, and an extensive Monte Carlo simulation to test the accuracy of the limits is summarized. Methods for designing the experiment so as to achieve a specified precision are given. GRA

N77-31190*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STATUS OF THE DEEP SPACE NETWORK-VOYAGER FLIGHT PROJECT TELECOMMUNICATIONS COMPATIBILITY Summary Report
A. I. Bryan, R. P. Kemp, and B. D. Madsen *In its* The Deep Space Network 15 Aug. 1977 p 21-40 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK TO VIKING ORBITER TELECOMMUNICATION LINK EFFECTS DURING 1976 SUPERIOR CONJUNCTION
F. H. J. Taylor *In its* The Deep Space Network 15 Aug. 1977 p 57-70 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31202*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
PHASE FLUCTUATION SPECTRA: NEW RADIO SCIENCE INFORMATION TO BECOME AVAILABLE IN THE DSN TRACKING SYSTEM MARK III-77
A. L. Berman *In its* The Deep Space Network 15 Aug. 1977 p 134-140 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
DSN RADIO SCIENCE SYSTEM MARK III-78 REAL-TIME DISPLAY CAPABILITY
A. L. Berman *In its* The Deep Space Network 15 Aug. 1977 p 141-145 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31204*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL-FREQUENCY FEED SYSTEM FOR 26-METER ANTENNA CONVERSION
R. W. Hartop *In its* The Deep Space Network 15 Aug. 1977 p 146-149 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

N77-31208*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
THE 64-METER ANTENNA PEDESTAL TILT AT DSS 43, TIDBINBILLA, AUSTRALIA
G. Gale and A. A. Riewe *In its* The Deep Space Network 15 Aug. 1977 p 168-173 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-31404* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TWIN-CAPACITIVE SHAFT ANGLE ENCODER WITH ANALOG OUTPUT SIGNAL Patent
Ronald J. Hruby and Robert L. Wilson, inventors (to NASA) (Technology Learning Corp., Sunnyvale, Calif.) Issued 2 Aug. 1977 9 p Filed 24 Oct. 1975 Supersedes N76-12338 (14 - 03, p 0307)
(NASA-Case-ARC-10897-1; US-Patent-4,040,041; US-Patent-Appl-SN-625781; US-Patent-Class-340-200; US-Patent-Class-323-93; US-Patent-Class-324-60; US-Patent-Class-340-347SH) Avail: US Patent Office CSCL 09C

A precision capacitive shaft encoder providing a dc signal corresponding to the angular position of a shaft is described. Two variable capacitances are coupled in tandem by a rotatable shaft. Each capacitor has a capacitance that varies linearly with a change in the angular position of the shaft. The sum of the two capacitances is always constant for any angular position of the shaft. Each capacitance is alternately coupled to a reference dc voltage and a discharge circuit. The capacitances are electrically coupled in series and the charge periodically acquired at the junction of the capacitance is a function of the position of the shaft. An error-compensating voltage is imposed on the junction when the capacitances are coupled to the reference voltages. The junction is coupled to sample-and-hold apparatus provided with a error-correcting circuit.
Official Gazette of the U.S. Patent Office

N77-31405*# Westinghouse Research Labs., Pittsburgh, Pa.
DEVELOPMENT OF A 1000V, 200A, LOW-LOSS, FAST-SWITCHING, GATE-ASSISTED TURN-OFF THYRISTOR Final Report
E. S. Schlegel, L. R. Lowry, and D. L. Moore 2 Sep. 1977 111 p refs
(Contract NAS3-16801)
(NASA-CR-134951; Rept-77-9F5-GATTT-R1) Avail: NTIS HC A06/MF A01 CSCL 09A

The results of a program to develop a fast high power thyristor that can operate in switching circuits at frequencies of 10 to 20 kHz with very low power loss are given. Feasibility was demonstrated for a thyristor that blocks 1000V forward and reverse, conducts 200A, turns on in little more than 2 more microseconds with only 2A of gate drive, turns off in 3 microseconds with 2A of gate assist current and has an energy dissipation of only 12 mJ per pulse for a 20 microsecond half sine wave 200A pulse. Data were generated that clearly showed the tradeoffs that can be made between the turn off time and forward drop. The understanding of this relationship is necessary in the selection of deliverable thyristors with turn off times up to 7 microseconds to give improved efficiency in a series resonant dc to dc inverter application. Author

N77-31406*# RCA Solid State Div., Somerville, N.J.
ACCELERATED LIFE TESTING EFFECTS ON CMOS MICROCIRCUIT CHARACTERISTICS Interim Report, Jan. - Jul. 1977
Jul. 1977 54 p
(Contract NAS8-31905)
(NASA-CR-150381) Avail: NTIS HC A04/MF A01 CSCL 09C

Accelerated life tests were performed on CMOS microcircuits to predict their long term reliability. The consistency of the CMOS microcircuit activation energy between the range of 125 C to 200 C and the range 200 C to 250 C was determined. Results indicate CMOS complexity and the amount of moisture detected inside the devices after testing influences time to failure of tested CMOS devices. Author

N77-31407*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DUAL MODE SOLID STATE POWER SWITCH Patent Application
Louis C. Maus (Sperry-Rand, Huntsville Ala.) and Donald E. Williams, inventors (to NASA) Filed 31 Aug. 1977 13 p
(NASA-Case-MFS-22880-2; US-Patent-Appl-SN-829321) Avail: NTIS HC A02/MF A01 CSCL 09A

A solid state amplifier has an output transistor stage and

an input transistor stage interconnected as a Darlington circuit. An interstage transistor interconnecting the collectors of the two stages of the Darlington circuit is connected with the first stage transistor in a compound configuration. When the load current furnished by the amplifier is less than a predetermined value, the output stage operates as a simple saturated switch with its base drive current flowing through the emitter-base junction of the first stage. This produces no collector current because the base-emitter junction of the interstage transistor is reverse-biased. When the load current exceeds said predetermined value, the interstage transistor begins to conduct, allowing the input and output stages to operate as a Darlington amplifier and diverting a significant portion of the base drive current of the output transistor b[illegible] into the load. NASA

N77-31408# Harry Diamond Labs., Washington, D.C.
INVESTIGATIONS INTO THE CAUSES OF VACUUM DEGRADATION IN A CERAMIC-TO-METAL SEAL VACUUM TUBE
William K. McNeil May 1977 50 p
(AD-A040111; HDL-TR-1800) Avail: NTIS HC A03/MF A01 CSCL 09/1

The root causes are explored for vacuum degradation in a vacuum tube ('bottle') that is constituted of a stacked assembly of alternately arranged metal and high alumina ceramic members. Vacuum degradation caused by leaking, permeation, or outgassing was investigated. Leaking, as a serious failure mode, was eliminated early in the investigation after it was determined that in failed items the ambient gases were predominately nitrogen and hydrogen and there was no oxygen. Additionally, the rate of change of gas pressure with time for failed assemblies was orders of magnitude less than that of any known real leak. Hydrogen was assumed to have entered the vacuum space via permeation, but exhaustive experimental and theoretical evidence revealed that niobium was the most permeable material in the vacuum envelope. However, permeation rates on vacuum bottles containing niobium yield storage life expectancies in excess of 20 yr. Data presented establish that a primary A2 failure mode is one in which microcracks through the ceramic intersect gas-filled pores (mostly nitrogen) and permit gas to degrade the vacuum. Additionally, thoriated tungsten filaments getter hydrogen gas at one time and after a diffusion lag time release this hydrogen into the vacuum space. Author (GRA)

N77-31409# Army Electronics Command, Fort Monmouth, N.J.
TRANSIENT WAVEFORM ANALYSIS OF SWITCHING CONVERTER
Emil Kittl Apr. 1977 51 p refs
(AD-A040123; ECOM-4493) Avail: NTIS HC A04/MF A01 CSCL 09/5

The dc to dc series resonance converter circuit using antiparallel diodes to introduce two additional controlled time intervals for diode conduction has been modeled as an idealized series capacitor resonance circuit with four cyclic switching states. For the two transistor and two diode conduction periods of these states, linear circuit analysis is used. The boundary conditions at the time interface between the four switching states are defined for automatic cyclic sequencing so that a continuous string of wave trains of converter operation results. The computer program is written in basic language. GRA

N77-31410# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRIC TECHNOLOGY Quarterly Technical Summary Report, 1 Nov. 1976 - 31 Jan. 1977
Melvin A. Herlin and Alan L. McWhorter 15 Feb. 1977 18 p refs
(Contract F19628-76-C-0002)
(AD-A040124; ESD-TR-77-37) Avail: NTIS HC A02/MF A01 CSCL 09/3

Contents: Digital Computers, Applications, Integrated Circuit Processing, Design, Analysis, and Testing, and Computer Systems; Division 8 Reports on Advanced Electronic Technology, Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. GRA

N77-31411# TRW, Inc., Redondo Beach, Calif. Semiconductor Div.
TOP COLLECTOR CONTACTED MICROWAVE POWER TRANSISTOR. MONOLITHIC MICROWAVE LUMPED ELEMENT INTEGRATED CIRCUIT PROGRAM, PHASE 2 Final Report, 18 Dec. 1975 - 24 Feb. 1977
Al Harrington, Bernie Lindgren, and George Schreyer Mar. 1977 61 p
(Contract N00014-75-C-0405)
(AD-A040910) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report covers the work on Naval Research Contract No. N00014-75-C-0405 (Top Collector Contacted Microwave Power Transistor). The objective of the contract is to investigate the monolithic integrated circuit approach for the fabrication of RF power transistors and associated matching networks to eliminate hand working, wire bonding and to provide improved uniformity, yield, reliability and ultimately, lower cost. Specifically, Phase II of this work calls for an isolated all top contacted 30 watt, 1.5 GHz power transistor. The devices meet or exceed all the contract requirements (30 watt at 1.5 GHz with 7 dB gain). The final processes used and the best results are discussed. Author (GRA)

N77-31412# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
DUAL-MODE LOGIC FOR FUNCTION INDEPENDENT FAULT TESTING Final Technical Report, Jun. - Oct. 1976
S. Dasgupta, C. R. P. Hartmann, and L. D. Rudolph Griffiss AFB, N. Y. RADC May 1977 40 p refs
(Contract F30602-71-C-0312)
(AD-A040611; Rept-76-11; RADC-TR-77-151) Avail: NTIS HC A03/MF A01 CSCL 09/5

A method of using hardware redundancy to ease the problem of fault testing in combinational and sequential logic circuits is presented. Dual-mode logic gates are used to construct combinational logic circuits which can be tested for all single stuck-at faults using just two function-independent tests. Analogous results for sequential circuits are also presented. Author (GRA)

N77-31413# RCA Advanced Technology Labs., Camden, N. J.
DIGITAL SYNTHESIZER AND CODE GENERATOR Final Report, 15 Jun. 1974 - 30 Dec. 1975
H. W. Kaiser, W. F. Gehweiler, J. I. Pridgen, and W. E. Arrowood Wright-Patterson AFB, Ohio AFAL Jun. 1976 192 p
(Contract F33615-74-C-1123)
(AD-A040156; ATL-CR-76-03; AFAL-TR-76-123) Avail: NTIS HC A09/MF A01 CSCL 09/5

The objective of this program was to design, fabricate, and test two building block modules for application to digital modems. The two modules selected for implementation were a digital code generator operating to 20 Mb/s and a digital synthesizer providing a 25-kHz bandwidth centered at 200 kHz, with a frequency resolution of 4 Hz. Both the code generator and frequency synthesizer modules were implemented using the silicon-gate CMOS/SOS technology. The code generator array contains a 16-stage sequence generator capable of being operated with various code lengths from 1 to 16 stages. The code generator operates at 20 Mb/s output rates at 10 V with approximately 105 mW of power dissipation. At 5 V the generator operates at 10 Mb/s with 10 mW of dissipation. The digital synthesizer LSI array that was designed under this program is coupled to a phase-locked loop and output bandpass filter to form the synthesizer module. Mounted on a 4.5 inch by 8.5 inch printed circuit [illegible], the synthesizer module provides for the generation of 419,430 frequencies over the 25-kHz band of interest. The frequency resolution of the delivered synthesizer is 0.0596 Hz, compared to the Government's original requirement for resolution of 4 Hz. Author (GRA)

N77-31414# Air Force Geophysics Lab., Hanscom AFB, Mass.
A COMPUTER CONTROLLED TRACKING SYSTEM: INTERFACE CIRCUITS DESIGN
Michael J. Sowa 15 Feb. 1977 24 p refs
(AD-A040745; AFGL-TR-77-0045; AFGL-IP-254) Avail: NTIS HC A02/MF A01 CSCL 09/6

In this report the design and application of the circuits used to interface a Lockhead SUE mini-computer with a Canoga Antenna Tracking System are described. Basic material on the

theory and application of the antenna tracking system is also presented. Author (GRA)

N77-31415# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
ANALYSIS OF SEMICONDUCTOR STRUCTURES BY NUCLEAR AND ELECTRICAL TECHNIQUES Interim Technical Report
Joseph M. Harris, Silvanus S. Lau, James W. Mayer, Marc-A. Nicoet, and Johnson O. Olowolafe Griffiss AFB, N. Y. RADC Jan. 1977 55 p refs
(Contract F19628-75-C-0008; AF Proj. 2305)
(AD-A040361; SR-4; RADC-TR-77-16) Avail: NTIS HC A04/MF A01 CSCL 09/1

MeV backscattering spectrometry and X-ray diffraction are used to investigate the behavior of sputter-deposited Ti-W mixed films on Si Substrates. During vacuum anneals at temperatures of 700 C for several hours, the metallization layer reacts with the substrate. Backscattering analysis shows that the resulting compound layer is uniform in composition and contains Ti, W and Si. The Ti:W ratio in the compound corresponds to that of the deposited metal film. X-ray analyses with Read and Guinier cameras reveal the presence of the ternary Ti(x)W(1-x)Si2 compound. Its composition is unaffected by oxygen contamination during anneal, but the reaction rate is affected. The rate measured on samples with about 15% oxygen contamination is linear, of the order of 0.5 A/sec at 725 C, and depends on the crystallographic orientation of the substrate and the d-c bias during sputter deposition of the Ti-W film. GRA

N77-31416# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
H-FIELD, E-FIELD, AND COMBINED FIELD SOLUTIONS FOR BODIES OF REVOLUTION Interim Report
Joseph R. Mautz and Roger F. Harrington Mar. 1977 52 p refs
(Contracts F19628-76-C-0300; F30602-75-C-0121)
(AD-A040379; RADC-TR-77-109; ITR-1) Avail: NTIS HC A04/MF A01 CSCL 20/3

H-field, E-field, and combined field solutions are developed for the electric surface current and far scattered fields of a perfectly conducting body of revolution excited by an incident plane wave. These solutions are obtained by applying the method of moments to the H-field, E-field, and combined field integral equations, respectively. The H-field integral equation is obtained by requiring the tangential magnetic field to be zero just inside the surface S of the body of revolution. The E-field integral equation is obtained by requiring the tangential electric field to be zero on S. The combined field integral equation is a linear combination of the H-field and E-field integral equations. Computations show that both the H-field and the E-field solutions deteriorate near internal resonances of the conducting surface S, but that the combined field solution does not. The computer program subroutines used to perform these computations will appear in a forthcoming report. Author (GRA)

N77-31417# Breuer and Associates, Encino, Calif.
INITIALIZATION OF DIGITAL LOGIC CIRCUITS
Melvin A. Breuer 25 Sep. 1976 96 p refs
(Contract N00014-75-C-1053)
(AD-A040270; TEST/80-2-76) Avail: NTIS HC A05/MF A01 CSCL 09/2

The initialization of a digital circuit can often be a complex process. The TEST/80 system being designed by Breuer and Associates is to contain a module for carrying out circuit initialization. Up until now, no algorithm existed which would guarantee constructing an initialization sequence for an arbitrary circuit. This report presents the results of research on developing techniques for inclusion in an initialization module. The techniques that have developed fall into two categories, namely algebraic procedures and prestored synchronizing sequences. Both of these categories can again be subdivided into two categories, namely exact procedures and heuristic procedures. This report illustrates and describes the various procedures we have developed, as well as present a flow chart of the initialization process being proposed. The appendix deals with implementation techniques for our algebraic procedures. GRA

N77-31418# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN ENERGY-BALANCE ANALYSIS OF THE INTERACTION BETWEEN CONDUCTING BODIES AND ELECTRIC FIELDS Final Report
William Bucher Apr. 1977 28 p
(AD-A041382; BRL-1983) Avail: NTIS HC A03/MF A01 CSCL 20/3

The application of the principle of energy-balance is an especially useful approach to problems for which a complete analytical solution is not possible but for which partial information can provide a thorough understanding of system dynamics. In this report the problem of N conducting bodies immersed in the electric field produced by a pair of electrodes is examined, and associated energy-balance equations are derived. These equations are applicable to a wide variety of problems. A theorem on the partition of energy for electrically neutral bodies is also presented. Author (GRA)

N77-31419# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SURVEY OF SOLID-STATE MICROWAVE POWER DEVICES
Peter W. Staecker and Dean F. Peterson 29 Apr. 1977 55 p refs
(Contract F19628-76-C-0002)
(AD-A041202; TN-1977-14; ESD-TR-77-84) Avail: NTIS HC A04/MF A01 CSCL 09/5

Current capabilities of solid-state microwave power devices useful for CW power amplification in satellite communication systems are described. Devices discussed in detail include IMPATT diodes, bipolar and field-effect transistors. Also discussed are transferred electron diodes and TRAPATT diodes. Topics considered include physical device description, circuit design and performance, reliability, applications, and future trends. Author (GRA)

N77-31420# Naval Civil Engineering Lab., Port Hueneme, Calif.
VALIDATION OF SIMULATION TECHNIQUES FOR ELECTROMECHANICAL COUPLINGS IN ELECTRICAL MOTORS Final Report
K. T Huang and D. M. Shiroma May 1977 27 p ref
(ZR00001142)
(AD-A041305; CEL-TN-1484) Avail: NTIS HC A03/MF A01 CSCL 09/3

High frequency injection and electromagnetic coupling techniques are used to measure the parameters of a single-phase induction motor to determine its equivalent circuit. This equivalent circuit is then programmed on the analog computer for verification. From the equivalent circuit, the electromechanical coupling which correlates the electrical and mechanical parameters can be determined. The analog simulation of the single-phase induction motor can then be used for experimentation, analysis, and design. Author (GRA)

N77-31421# Raytheon Co., Bedford, Mass. Missile Systems Div.
DESIGN AND ANALYSIS OF BIFURCATED TWIN DIELECTRIC SLAB LOADED RECTANGULAR WAVEGUIDE. DUAL FREQUENCY ARRAY ELEMENTS Final Report, Jan. 1976 - Feb. 1977
J. H. Pozgay, M. Fassett, and L. R. Lewis 1 Mar. 1977 246 p refs
(Contract F19628-75-C-0197)
(AD-A041321; BR-9674; RADC-TR-77-160) Avail: NTIS HC A11/MF A01 CSCL 09/5

The design and analysis of a unique dual frequency array element and three probe element exciters for aperture sharing at two widely separated frequency bands is presented. The bifurcated twin dielectric slab loaded rectangular waveguide element simultaneously supports a single low frequency band phase center and four independently controllable high frequency phase centers, resulting in the formation of an independent radiating beam in each band. The principle element design objective is to minimize the element count while maximizing the rejection of high frequency grating lobes. It is shown that the slab loaded element results in 21 percent fewer phase and frequency control per unit array area than an alternate diplexed wide band element dual frequency concept for a scanning array

operated over 15 percent bands centered at 4 and 8 GHz. The radiation and coupling properties of the array element are developed from a scattering formulation of the feedguide - free space discontinuity for the fully excited infinite array. Comparison of theoretical performance for triangular and rectangular grid configurations shows that considerable improvement in high frequency grating lobe rejection is obtained from the triangular lattice. To characterize the transverse aperture fields, a complete modal description of propagation in the inhomogeneously loaded guide is obtained through a component-by-component comparison of the degenerate eigen-functions of the structure. GRA

N77-31422# Rhode Island Univ., Kingston. Dept. of Mathematics.
ANTENNA DESIGN AS A PARTIAL BASIS PROBLEM
Kenneth M. Levasseur and James T. Lewis Jun. 1977 21 p refs
(Grant AF-AFOSR-3174-77)
(AD-A041750; AFOSR-77-0798TR; TR-66) Avail: NTIS HC A02/MF A01 CSCL 09/5

The following problem comes from that of choosing best locations for antenna elements in a linear array. Given a function f and linearly independent functions hsub1, hsub2..., hsubn, choose, for a given n(-N), n of the h's to give a closest linear approximation of f. Both a computational algorithm and theoretical results are given. GRA

N77-31423# Boeing Co., Seattle, Wash.
ADVANCED ELECTRON BEAM DIAGNOSTICS Final Report, 24 Jun. 1975 - 10 Mar. 1976
John L. Adamski, Brian M. Lempriere, and John E. Shrader Apr. 1977 92 p refs
(Contract F29601-75-C-0124)
(AD-A041666; D180-19431-2; AFWL-TR-76-196) Avail: NTIS HC A05/MF A01 CSCL 07/4

An experimental study was conducted to determine the feasibility of using two pyrometric techniques to provide diagnostic tools for electron-beam irradiation experiments. In one technique, an image converter camera was used to photograph the self-luminescent surface of irradiated specimens at various times after the end of irradiation. This instrument determined the spatial distribution of target temperature on the front and back faces of specimens in beam fluences up to target vaporization. In the other technique, optical pyrometry was used with several channels observing different wavelengths and/or target points. Both fast photomultipliers and a silicon diode (IR) were used to measure the self luminescent light from the test specimen irradiation which was then correlated with temperature. The results of tests conducted at the Boeing Radiation Effects Laboratory are reported and analyzed, and demonstrate the feasibility and limitations in use of these techniques. A qualitative study of the luminous sources in an electron beam irradiation environment is also given. Author (GRA)

N77-31424# Illinois Univ., Urbana-Champaign.
DESIGN CONSIDERATIONS AND TRADE-OFFS IN MOS/LSI M.S. Thesis
Alan Dale Grant Apr. 1977 93 p refs
(Contract DAAB07-72-C-0259; NSF-MCS-73-03488)
(AD-A041687; R-764; UILU-ENG-77-2211) Avail: NTIS HC A05/MF A01 CSCL 09/5

In order to be cost-effective, digital circuits implemented in MOS large scale integration (LSI) are designed with close regard to optimality. Three criteria - power dissipation, chip area (cost), and speed - are balanced to produce a final circuit. Current practices involve a significant amount of simulation to determine the most satisfactory trade-offs. This project is concerned with the prediction of optimal values of certain design parameters for a given function of the above three criteria. This paper first develops a simplified model for MOS/LSI circuits. Using this model, equations are derived for circuit speed, power dissipation, and area. These equations are expressed as functions of the channel dimensions of the MOS transistors and of the degree of pipelining of the circuit. These three equations, and their pairwise products, are then optimized. The relationships between the equations and the parameters are examined. The effects and trade-offs of particular design choices are described. Author (GRA)

N77-31425# Mitre Corp., McLean, Va.
BENEFIT-COST EVALUATION OF THE ERDA FOSSIL ENERGY COMBUSTION AND ADVANCED
L. Bertman, D. Cox, G. Lamb, J. Morris, J. Pfeffer, and M. Rivas Jul. 1976 183 p refs
(Contract EX-76-C-01-2453)
(FE-2453-1) Avail: NTIS HC A09/MF A01

The implications of the investment of Federal funds in the ERDA/Fossil Energy Combustion and Advanced Power Development (CAPD) Program are assessed. Technologies considered in this study include five advanced systems under development in the CAPD Program and other baseline systems competing in the electric utility market for new base- and intermediate-load generating capacity. Life cycle busbar costs of electric power for each system are calculated, based upon estimated performance and cost characteristics. Market shares by region and year are estimated for the systems, and the benefits associated with the projected Federal investment are determined. ERA

N77-31426# California Univ., Livermore. Lawrence Livermore Lab.
STORED ENERGY IN TRANSFORMERS: CALCULATION BY A COMPUTER PROGRAM
P. A. Willmann and E. B. Hooper, Jr. Feb. 1977 26 p ref
(Contract W-7405-eng-48)
(UCID-17389) Avail: NTIS HC A03/MF A01

A computer program was written to calculate the stored energy in a transformer. This result easily yields the inductance and leakage reactance of the transformer and is estimated to be accurate to better than 5 percent. The program was used to calculate the leakage reactance of the main transformer for the LLL neutral beam High Voltage Test Stand. ERA

N77-31427# Sandia Labs., Albuquerque, N. Mex.
REVIEW OF FILAMENT GROWTHS AND CORROSION EFFECTS CAUSED BY MOISTURE FILMS AND dc BIAS BETWEEN MICROCIRCUIT CONDUCTORS
C. W. Jennings Jan. 1977 25 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0007) Avail: NTIS HC A02/MF A01

Published information on dendritic or migratory filament growths and corrosion or other effects caused by electrolytic currents on hybrid microcircuits is reviewed. These effects have caused circuit malfunctions through high resistance shorts, leakage paths or circuit opens. Electrolytic currents are produced when there are condensed moisture films and dc bias between conductors. Residual salts such as chlorides are required for some but not all circuits for filament generation. Hermetic packaging, encapsulation, and coating are means used to restrict moisture from the circuitry and reduce or eliminate current formation. For these methods to be effective, proper precautions must be exercised in cleaning and processing operations prior to and during covering operations. Although the information was obtained mainly from microcircuit studies, there is much which is applicable to macrocircuits such as printed boards and connectors. ERA

N77-31428# Los Alamos Scientific Lab., N. Mex.
METHODOLOGY FOR THE ANALYSIS OF THE IMPACTS OF ELECTRIC POWER PRODUCTION IN THE WEST
A. Ford and H. W. Lorber Jan. 1977 27 p refs
(Contract W-7405-eng-36)
(LA-6720-PR) Avail: NTIS HC A03/MF A01

The project objective is to design a computer-based tool to help decision makers analyze some of the crucial environmental, social, and economic impacts-particularly the following impacts which involve conditions that are unique to the West: the boom town impacts that result from the contruction and operation of power plants near small, isolated towns in the sparsely populated West; and the reduction in visibility caused by the fossil-fuel emissions from per plants, operating in the pristine West. Additional impacts that were addressed include public health effects from fossil-fuel pollutants, occupational health and safety, and the risk of accidental release of radioactive pollutants from nuclear power plants. The scale along which most of these varied impacts are compared is dollars. As an example, the report used to calculate impacts associated with the 1985 expansion plan

of the electric utilities belonging to the Western Systems Coordinating Council. ERA

N77-31429# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
A STEP MOTOR CONTROLLER FOR A PAN/TILT HEAD M.S. Thesis
Clifford Calvin Geschke Dec. 1976 52 p refs
(Contract DAAB07-72-C-0259)
(AD-A040761; ENG-76-2240; R-752) Avail: NTIS HC A04/MF A01 CSCL 09/2

Research into computer vision and image processing is currently being conducted in many places for a great variety of applications. In the Coordinated Science Laboratory at the University of Illinois, emphasis has been placed upon the development of a real-time vision system, that is, one which is capable of interacting with a dynamic environment such as an assembly line in motion, or an active robot manipulator. Author (GRA)

N77-31430# Massachusetts Inst. of Tech., Cambridge.
TECHNOLOGY AND PHYSICS OF INFRARED AND POINT CONTACT DIODES Semiannual Technical Report, 1 May - 31 Oct. 1976
Aii Javan Jan. 1977 18 p
(Contract F19628-74-C-0182; ARPA Order 2618)
(AD-A040050; RADC-TR-77-52; SATR-5) Avail: NTIS HC A02/MF A01 CSCL 17/5

Masks were obtained to make the far infrared holographic antenna/diode array which had been designed earlier. Fabrication parameters were investigated, and a procedure was established. Electrical characteristics of the junctions are described. Most good arrays are matched in resistance within a factor of two. About 20 microvolts of rectified voltage was obtained from one of these early junctions with far infrared radiation focused on the antenna. Response of Al-Al2O3-Pb junctions to visible laser radiation at liquid helium temperature has been studied. Attempts to observe negative resistance in Sn-SnO-Pb junctions were frustrated by junction damage during the process of soldering test leads to the contact pads. A point contact mixer assembly for adjustment and use at liquid helium temperature has been designed and fabrication begun. Two patents covering optical addressing of high speed memory devices were refiled with the U.S. Patent Office, and patents were filed in Germany and Japan. GRA

N77-31431# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
ADVANCED EPITAXIAL FERRITE DEVICES Final Report, 19 Jan. 1976 - 19 Jan. 1977
W. L. Bongianni 19 Jan. 1977 21 p
(Contract DAAG29-76-C-0017)
(AD-A040326; C77-51/501; ARO-13178.1.EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

Using a class of materials referred to as hexagonal ferrites, magnetically tunable filters in the millimeter wave range becomes a practical possibility. Because of their large inherent magnetic anisotropy, the hexaferrites can be biased into the millimeter wave range with relatively small external fields. It was the purpose of this contract to explore the use of epitaxial films of hexagonal ferrites as an alternative to bulk grown single crystal material. Since epitaxial films can be grown with a damage-free surface, no mechanical handling would be required. Bandstop filters using this material were fabricated and the characteristics were measured. Using parallel resonance a bandstop response at 39.1 GHz was obtained with an unloaded Q of 400. In perpendicular resonance, the film was linearly tuned across the 50 to 60 GHz range with a variable field which did not exceed 2000 gauss. In both cases only a minimum of mechanical processing was used. Author (GRA)

N77-31432# National Bureau of Standards, Washington, D. C. Electronic Technology Div.
MEASUREMENT OF TRANSISTOR COLLECTOR-EMITTER SATURATION VOLTAGE Final Report, Jul. 1976 - Jan. 1977
Kathryn Leedy Jun. 1977 55 p
(AD-A040688; NBSIR-77-1231) HC A04/MF A01 CSCL 09/1

This report presents a detailed method for the measurement of collector-emitter saturation voltage. The method which is included in the Appendix is proposed for standardization. The report also contains a description of the laboratory confirmation of the method and a discussion of the precautions to be taken to assure repeatability of the measurement. Emphasized is the necessity to determine that the conditions for saturation are met during the measurement. Author (GRA)

N77-31433# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
SYSTEM TESTING AND DESIGN FOR DIAGNOSABILITY Final Report
M. A. Breuer, A. D. Friedman, and J. P. Hayes Jul. 1976 17 p refs
(Contract N00014-A-0269-0019; N00014-76-C-0168)
(AD-A040518) Avail: NTIS HC A02/MF A01 CSCL 09/3

It is known that many practical sequential circuits cannot be treated by single multivalued systems. The reason for this failure is the loss of information, which is inherent to the use of x as a unique unknown. It is natural to overcome this difficulty by algebraic methods. GRA

N77-31434# RCA Solid State Technology Center, Somerville, N. J.
HIGH-RELIABILITY, LOW-COST INTEGRATED CIRCUITS Quarterly Development Report, 3 Feb. - 3 May 1977
May 1977 24 p refs
(Contract N00039-76-C-0240)
(AD-A041778) Avail: NTIS HC A02/MF A01 CSCL 09/5

Wafer fabrication for the CA741, 5420, 54S20, 5470, 5472, CD4012B, CD4027B, and CD4014A has been initiated. Lead wafers for most of the circuits are in the metallization process. The required array of life-test sockets for each type has been ordered, and samples of CD4012B and CA741 are being assembled for accelerated life test and step-stress testing. Initial reliability data obtained on CA741 devices indicate that the contract goal of less than 0.005% failures per 1000 hours at 125 C operating life is attainable. Author (GRA)

N77-31435# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON-LINE TRANSIENT CONTROL OF POWER SYSTEMS Final Report, 15 Feb. 1972 - 31 Jan. 1975
P. C. Krause 31 Jan. 1975 104 p
(Grant NSF GI-32605X2)
(PB-267870/4; NSF/RA/N-75/081) Avail: NTIS HC A06/MF A01 CSCL 09C

The following are reviewed: (1) on-line transient and optimal control studies; (2) transmission line simulation; (3) equivalent models for transient stability studies; and (4) simulation of unbalanced operation. The transmission line research has led to the development of lumped and distributed parameter representations valid for low frequency transients. Results of the research were used to solve a network unbalance problem. The simulation techniques developed offer the advantage of fast computation with accuracy and flexibility. Effort was also directed toward the development of reduced order models of induction and synchronous machines valid for transient stability studies. GRA

N77-31205*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
INTERMODULATION COMPONENTS IN THE TRANSMITTER RF OUTPUT DUE TO HIGH VOLTAGE POWER SUPPLY RIPPLE
E. J. Finnegan *In its* The Deep Space Network 15 Aug. 1977 p 150-151 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 09C

N77-31206*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
MEASUREMENT OF KLYSTRON PHASE MODULATION DUE TO ac-POWERED FILAMENTS
E. J. Finnegan *In its* The Deep Space Network 15 Aug. 1977 p 152-153 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N77-31436 Polish Academy of Sciences, Warsaw.
PROBLEMS OF THERMAL STRESSES IN STEEL HOT LIQUID CONTAINERS [ZAGADNIENIA NAPREZEN TERMICZNYCH W ZBIORNIKACH STALOWYCH NA CIECZE GORACE]
Z. F. Baczynski and K. Reginski 2 Dec. 1976 108 p refs In POLISH
Avail: Issuing Activity

Stationary (determined) and nonstationary (time-dependent) distributions of temperature in a closed cylindrical steel container for hot liquids, noninsulated and insulated from within are analyzed. Thermal stresses are studied in the cylindrical shell and in the bottom plate structure with the lower edge completely hardened or with a bottom plate based on a rigid or elastic foundation (the Winkler type). Author

N77-31437 Polish Academy of Sciences, Warsaw.
THE EFFECT OF GAS HETEROGENEITY ON THE PROCESS OF SHOCK WAVE REFLECTION [UPLYW NIEJEDNOROD-NOSCI GAZU NA PROCES ODBICIA FALI UDERZEN-IOWEJ]
Zbigniew Walenta, A. 1 Dec. 1976 28 p refs In POLISH
Avail: Issuing Activity

A method is presented for estimating the influence of the heterogeneity of through-flow behind a primary shock wave on the process of wave reflection from a perpendicular or oblique shock tube head. The method is shown to give results which are qualitatively equal in comparison with an experiment. Since the permissible perturbances of the effect are basically small, the method of linearization gives correct quantitative results. Author

N77-31438# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
STUDY OF TURBULENT WAKE STRUCTURE BEHIND A CIRCULAR CYLINDER WITH AND WITHOUT END PLATES BY MEASURING NATURAL TEMPERATURE FLUCTUATIONS [UNTERSUCHUNG DER STRUKTUR EINES NACHLAUFES HINTER EINEM KREISZYLINDER MIT UND OHNE ENDSCHEIBEN MITTELS MESSUNG DER NATUERLICHEN TEMPERATURSCHWANKUNGEN]
F. Albers, D. W. Schmidt, and W. J. Wagner Apr. 1977 56 p refs In GERMAN
(Ber-25/1976) Avail: NTIS HC A04/MF A01

Temperature fluctuations were used to show that the turbulent wake structure behind a cylindrical rod is altered when circular symmetrical end plates are attached to the rod. The described arrangement diminished three dimensional eddy formations and narrowed the width of the wake. Transl. by G.G.

N77-31439*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY ANALYSIS OF REMOTE INFRARED IMAGERY OF SHUTTLE DURING ENTRY: AN AEROTHERMODYNAMIC FLIGHT EXPERIMENT
Byron L. Swenson and Larry E. Edsinger Aug. 1977 30 p refs
(NASA-TM-73251; A-6995) Avail: NTIS HC A03/MF A01 CSCL 20D

The preliminary feasibility of remote high-resolution infrared imagery of the space shuttle orbiter lower surface during entry to obtain accurate measurements of aerodynamic heat transfer to that vehicle was examined. In general, it was determined that such such images can be taken from an existing aircraft/telescope system (the C-141 AIRO) with a minimum modification or addition of systems using available technology. These images will have a spatial resolution of about 0.3 m and a temperature resolution much better than 2.5 percent. The data from these images will be at conditions and at a scale not reproducible in ground based facilities and should aid in the reduction of the prudent factors of safety required to account for phenomenological uncertainties on the thermal protection system design. Principal phenomena to be observed include laminar heating, boundary-layer transition, turbulent heating, surface catalysis, and flow separation and reattachment. Author

N77-31440*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HEAT-TRANSFER AND PRESSURE MEASUREMENTS ON A SIMULATED ELEVON DEFLECTED 30 DEG NEAR FLIGHT CONDITIONS AT MACH 7
Charles B. Johnson, Allan H. Taylor, (Vought Corp., Hampton, Va.), and Irving Weinstein Sep. 1977 36 p refs
(NASA-TM-X-3563; L-11524) Avail: NTIS HC A03/MF A01 CSCL 20D

Heat transfer rates and pressures were obtained on an elevon plate (deflected 30 deg) and a flat plate upstream of the elevon in an 8 foot high-temperature structures tunnel. The flight Reynolds number and flight total enthalpy for altitudes of 26.8 km and 28.7 km at Mach seven were duplicated. The heat transfer and pressure data were used to establish heating and pressure loads. The measured heating was compared with several theoretical predictions, and the closest agreement obtained with a Schultz-Grunow reference enthalpy method of calculation. Author

N77-31441*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REPRESENTATION OF TURBULENT SHEAR STRESS BY A PRODUCT OF MEAN VELOCITY DIFFERENCES
Willis H. Braun Sep. 1977 50 p refs
(NASA-TP-1029; E-9057) Avail: NTIS HC A03/MF A01 CSCL 20D

A quadratic form in the mean velocity for the turbulent shear stress is presented. It is expressed as the product of two velocity differences whose roots are the maximum velocity in the flow and a cutoff velocity below which the turbulent shear stress vanishes. Application to pipe and channel flows yields the centerline velocity as a function of pressure gradient, as well as the velocity profile. The flat plate, boundary-layer problem is solved by a system of integral equations to obtain friction coefficient, displacement thickness, and momentum-loss thickness. Comparisons are made with experiment. Author

N77-31442# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
SURFACE REACTIONS Final Report, 1 Jan. 1975 - 28 Feb. 1977
Judson R. Baron Apr. 1977 8 p refs
(Contract F44620-75-C-0040)
(AD-A039214; AFOSR-77-0622TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The broad concern of the research program during the last two years has been energy exchange phenomena that relate to problems of high speed and/or altitude flight conditions. The specific study areas divide into those concerned with particle interactions at a surface which is adjacent to a fluid and those for which radiative exchange between a surface and its induced disturbance field is of dominant importance to the energy transfer. The gas-surface portion of the effort was motivated to a large extent by previous study of graphite oxidation which was carried out with a molecular beam system using dissociated oxygen. The radiation gas dynamics portion represents the culmination of analytical efforts to develop some understanding of coupling modeling and its influence on the predicted rates of energy transfer to a surface during flight situations. Author (GRA)

N77-31443# New York Univ., Westbury. Aerospace and Energetics Lab.
INVESTIGATION OF THE PROPAGATION MECHANISM OF PRESSURE FLUCTUATIONS IN TURBULENT FLOW Annual Report
Victor Zakkay, Vincent Barra, and Chi R. Wang Dec. 1976 109 p refs
(Grant AF-AFOSR-2942-76)
(AD-A036567; AFOSR-77-0099TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

A wind tunnel facility with extremely low noise levels has been designed, constructed, and tested. The facility was designed as an induction tunnel in order to minimize the influence of the downstream region of the wind tunnel on the flow field in the test section. This report presents a description of the facility and the flow quality obtained, and a discussion of the instrumentation and experimental procedures being used. The results obtained from the analysis of several measurements include spectra of the velocity, wall-pressure and wall-shear fluctuations, and a digital processing scheme which conditionally samples the fluctuations to obtain a description of turbulent bursts in the boundary layer. Author

N77-31444# Universal Energy Systems, Inc., Dayton, Ohio.
FLUID DYNAMIC ENERGY CONVERSION AND TRANSFER PROCESSES Final Report, 18 Mar. 1973 - 30 Jun. 1976
Ernest F. Fretter, Krishan K. Joshi, and Russell W. Griffith Wright-Patterson AFB, Ohio AFFDL Oct. 1976 241 p refs
(Contract F33615-73-C-4053; AF Proj. 1929)
(AD-A040589; AFFDL-TR-76-96) Avail: NTIS HC A11/MF A01 CSCL 20/4

This is the final report of research performed on Contract F33615-73-C-4053. The research which included three different work areas, Electrofluid Dynamics (EFD), Multi Component Flows (MCF), and Thrust Augmentation (TA). This report presents the experimental rigs designed and built, experiments performed, and the results of this project's experiments during the contract period. GRA

N77-31445# Purdue Univ., Lafayette, Ind.
TURBULENCE IN INTERNAL FLOWS. TURBOMACHINERY AND OTHER APPLICATIONS
S. N. B. Murthy, ed. May 1977 563 p refs Workshop held on 14-15 Jun. 1976
(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-038)
(AD-A040966; SQUID-PU-R1-77) Avail: NTIS HC A24/MF A01 CSCL 20/4

This report contains the proceedings of the Workshop on Turbulence in Internal Flows (Turbomachinery and Other Applications) held on June 14-15 1976. In addition to twenty-one papers and discussions on them, the proceedings include an introduction, panel discussion and summary report. The papers are presented in three groups as follows: Part I: Fundamental Problems, Part II: Modelling Procedures and Part III: Turbomachinery Applications. GRA

N77-31446# Naval Surface Weapons Center, White Oak, Md.
ANALYTICAL MODEL FOR PREDICTING THE DYNAMIC BEHAVIOR OF CAVITIES Interim Report, 1 Jul. 1975 - 30 Jun. 1976
Charles W. Smith Jul. 1976 38 p refs
(SR1230102)
(AD-A040977; NSWC/WOL/TR-76-114) Avail: NTIS HC A03/MF A01 CSCL 20/4

The first iteration in the development of an analytical model for predicting the dynamic behavior of cavities is near completion. A model to predict the cavity pressure and mass attrition needs to be developed. The predictions of the present model for the diameter and length of steady-state cavities agrees very well with experimental data. The need for reliable drag coefficients at high cavitation numbers is cited and it is recommended that future experimental work to be conducted at ARL include the measurement of drag forces in order to correct this deficiency. Author (GRA)

N77-31447# United Technologies Research Center, East Hartford, Conn.
A STUDY OF THE TURBULENT SHOCK WAVE BOUNDARY LAYER INTERACTION Final Report, 1 Jul. 1973 - 25 Oct. 1976
Ralph Levy, Stephen J. Shamroth, Howard J. Gibeling, and Henry McDonald 18 Feb. 1977 80 p refs
(Contract F33615-73-C-4119; AF Proj. 7064)
(AD-A040843; UTRC/R76-911729-15; AFFDL-TR-76-163) Avail: NTIS HC A05/MF A01 CSCL 20/4

Two approaches to the shock wave-boundary layer interaction procedure have been investigated. In the first approach a strong interaction boundary layer procedure has been applied to the shock wave-turbulent boundary layer interaction problem by modifying a well-proven weak interaction boundary layer procedure to allow for strong interaction solutions. In the second approach the feasibility of using a fully implicit Navier-Stokes solution procedure for the interaction problem was investigated. The results indicate that the fully implicit procedure is a promising one, however, further development work, particularly in regard to shock representation, is required. GRA

N77-31448# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
A GENERAL COST STRUCTURE FOR THE SEMI-MARKOV SHOCK MODEL Interim Report
Richard M. Feldman Jun. 1977 13 p refs
(Grant AF-AFOSR-3111-76)
(AD-A041485; AFOSR-77-0764TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

The semi-Markov shock model represents a system where shocks occur at random points in time causing random magnitudes of damage in such a way that the cumulative damage to the system over time is a semi-Markov process. System failure can occur at any of the shock times and the probability of failure is a function of the cumulative damage. An optimal control limit type policy has previously been derived assuming that costs are incurred at the replacement time. This note is to show that the inclusion of state dependent maintenance costs does not significantly affect the form of the optimal control limit. Author (GRA)

N77-31449# Geoscience, Ltd., Solana Beach, Calif.
THE DEVELOPMENT OF METHODOLOGY FOR THE DETERMINATION OF R VALUES OF EXISTING STRUCTURES BY NONSTEADY STATE HEAT TRANSFER MEASUREMENTS Final Report, 1 May - 30 Jun. 1976
H. F. Poppendiek, D. J. Connelly, E. W. Fowler, Jr., and E. M. Boughton Jun. 1976 27 p refs
(Contract N62583-76-M-W928; ZF57571001)
(AD-A041235; GLR-171; CEL-CR-77-015) Avail: NTIS HC A03/MF A01 CSCL 20/13

Energy conservation surveys of Navy facilities often require data on in-place R-values of existing structures. Such information has been difficult to obtain due to transient conditions caused by day-and-night temperature changes. This study indicates R-values can be calculated within about a 6% accuracy from heat flux and inside-outside wall surface temperature data that have been integrated over a 24-hour period. Author (GRA)

N77-31450# Indianapolis Center for Advanced Research, Ind. Fluid Dynamics Labs.
THE MODELLING OF A TURBULENT NEAR WAKE USING THE INTERACTIVE HYPOTHESIS Final Report, 1 Apr. 1974 - 1 Jul. 1976
G. D. Huffman and B. S. Ng 1976 50 p refs
(Contract F44620-74-C-0065; AF Proj. 9781)
(AD-A041487; FDL-77-001; AFOSR-77-0181TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A semi-empirical mathematical model for a turbulent near wake has been developed within the framework of an 'interaction hypothesis' suggested by Bradshaw. The near wake behind an airfoil has been treated as a 'complex' shear flow consisting of two neighboring simple shear layers with distinct but overlapping shear stress profiles of opposite signs. The present model utilizes the mean momentum and continuity equations together with two shear stress transport equations derived from the turbulent kinetic energy equation. By relating the shear stresses to the local turbulence equantities, closure for the governing systems is achieved without the use of the eddy viscosity concept. The shear stress is therefore no longer required to vanish at the velocity extremum. The model has been compared to the experimental data of Chevray and Kovasznay, and good agreement has been obtained. A comparison with the asymmetric cascade wake data of Raj and Lakshminarayana is also presented. Our calculations have validated the basic philosophy of an interactive approach in the study of near wakes. However, it also clearly demonstrates that the accuracy of certain empirical functions used to define the turbulence structure has a direct impact on the success of this or any other calculation method. Author (GRA)

N77-31451# Nielsen Engineering and Research, Inc., Mountain View, Calif.

COMPUTER PROGRAM FOR CALCULATION OF SEPARATED TURBULENT FLOWS ON AXISYMMETRIC AFTERBODIES Final Report, 15 Mar. 1976 - 15 Apr. 1977

Gary D. Kuhn Jun. 1977 94 p refs

(Contract F40600-76-C-0009)

(AD-A041219; NEAR-TR-131; AEDC-TR-77-72) Avail: NTIS HC A05/MF A01 CSCL 20/4

A computer code for a turbulent boundary-layer, inviscid interaction method for axisymmetric configurations of the type used for isolated nozzle afterbody models is presented. The method is applicable to flows subsonic free streams, including slightly supercritical flows. The method consists of an integral boundary-layer method and a finite-difference inviscid-flow method which are coupled iteratively through the boundary-layer displacement thickness. Both attached and separated boundary layers can be calculated. An option is provided for calculating two-dimensional boundary layers. The procedure for separated flows is to specify the displacement thickness of the boundary layer and calculate the free-stream velocity distribution from both the boundary-layer equations and the inviscid-flow equations. The separation point location and the angle of the displacement surface are found by an iterative procedure. The equations programmed are presented along with detailed instructions for the preparation of input data, description of the program output and instructions for operation of the program on an IBM 370 computer. Sample cases are provided for a complete axisymmetric interaction calculation and for a two-dimensional boundary-layer calculation. GRA

N77-31452# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

UNSTEADY MOTION OF SHOCK WAVES IN TWO DIMENSIONAL TRANSONIC CHANNEL FLOWS Final Technical Report, 15 May 1976 - 15 Jun. 1977

T. C. Adamson, Jr. and M. S. Liou Jun. 1977 68 p refs

(Contract N00019-76-C-0435)

(AD-A041573; Rept-014534-F) Avail: NTIS HC A04/MF A01 CSCL 20/4

Two dimensional unsteady transonic channel flow with a shock wave is considered for the so-called slowly varying time regime. Solutions are studied for two specific cases within this general time regime, the cases corresponding to small and large amplitude shock wave motions. For the large amplitude case, conditions are considered under which the shock wave travels upstream of the throat, disappears, and then reforms at the throat. A unified solution which covers both cases is developed. Numerical results are presented. A short discussion of shock induced separation in unsteady flows is given. Author (GRA)

N77-31453# Ballistic Research Labs., Aberdeen Proving Ground, Md.

COMPUTATIONS OF TURBULENT BOUNDARY LAYER DEVELOPMENT OVER A YAWED, SPINNING BODY OF REVOLUTION WITH APPLICATION TO THE MAGNUS EFFECT Final Report

Walter B. Sturek, Harry A. Dwyer, Lyle D. Kayser, Charles J. Nietubicz, and Robert P. Reklis May 1977 35 p refs

(AD-A041338; BRL-1985) Avail: NTIS HC A03/MF A01 CSCL 20/4

Many projectiles are slender bodies of revolution which are launched at high spin rates. Magnus forces and moments are generated by the distorted boundary layer which results from a spinning body at angle yaw. The Ballistic Research laboratory is conducting and supporting theoretical and experimental Magnus research efforts. The theoretical effort involves: (1) numerical calculation of the fully three-dimensional boundary layer with the added complication of interaction between surface spin and cross flow velocity; (2) three-dimensional inviscid flow calculations over a body plus boundary layer displacement surface with no plane of symmetry. Several types of experimental data, such as surface pressures, Magnus forces, boundary layer surveys, flow visualization, and skin friction, were obtained to evaluate and provide guidance to the theoretical effort. Comparison of the theory to experimental data shows the agreement to be very good. Author (GRA)

N77-31454# Sandia Labs., Albuquerque, N. Mex.

STABILITY ANALYSIS OF THE VON NEUMANN-RICHTMYER DIFFERENCE SCHEME WITH RATE DEPENDENT MATERIAL RELATIONS

D. L. Hicks Feb. 1977 34 p refs

(Contract E(29-1)-789)

(SAND-76-0634) Avail: NTIS HC A03/MF A01

Hydrocodes using the von Neumann-Richtmyer difference scheme use a timestep restriction of the form a(delta t/(delta mu) less than 1 where delta t and delta mu are time and material increments and a is the acoustic impedance. (Actually, the addition of artificial viscosity causes an effective amplification of the acoustic impedance which results in a more complicated inequality that essentially retains the same form as the above.) If the stress depends on strain rates, then in certain cases the timestep restrictions become more severe. Two such cases are Malvern- and the Navier-Stokes type rate dependence. In the Navier-Stokes case the timestep restriction is essentially of the form 2 lambda delta t/delta mu square less than 1 where lambda is the coefficient of the Navier-Stokes viscosity. In the case of Malvern-type rate dependence the timestep restriction is of the form [a(delta t)/(delta mu)] quantity squared + delta t/(2 tau) less than 1 where tau is the relaxation time of the material. ERA

N77-31455# Chr. Michelsen Inst., Bergen (Norway). Avdel. for Naturvidenskap og Teknikk.

A PROGRAM FOR INTERACTIVE SIMULATION OF THE MOTIONS OF FLOATING STRUCTURES. MAINTENANCE MANUAL

Jan N. Langfeldt 21 Mar. 1976 91 p Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.

(CMI-74091-3) Avail: NTIS HC A05/MF A01; Chr. Michelsens Inst., Bergen N.Kr. 80

Data structure and the routines written for an interactive simulation program of structures floating on water exposed to waves, wind, and currents are described. The structures may be held in position by anchors or thrustors or both. The program consists of two main parts: the first, reading input parameters from cards and making changes to these parameters on a TTY during the simulation (on-line changes); the other, performing the calculation of a structure motion as function of time (motion simulation). ESA

N77-31456# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

EXPERIMENTAL INVESTIGATIONS OF LONGITUDINAL VARIATIONS OF THE VELOCITY VECTOR AND THE ROTATION OF THE VELOCITY VECTOR IN A FULLY DEVELOPED TURBULENT CHANNEL FLOW Ph.D. Thesis - Goettingen Univ., West Ger. [EXPERIMENTELLE UNTERSUCHUNGEN DER LAENGSSCHWANKUNGEN DES GESCHWINDIGKEITSVEKTORS UND DER ROTATION DES GESCHWINDIGKEITSVEKTORS IN EINER AUSGEBILDETEN TURBULENTEN KANALSTROEMUNG]

Eleftherios G. Kastrinakis Jan. 1977 84 p refs In GERMAN (MPIS-5/1977) Avail: NTIS HC A05/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 17.40

Measurements were carried out of the longitudinal variations of the velocity and the vortex vector in a fully developed turbulent channel flow. The Reynolds number obtained with the mean velocity in the channel center and the width of the wind tunnel test section was 12500. Hot-wire anemometers allowed direct and simultaneous measurement of the longitudinal component of the vortex vector and the velocity. The distribution of longitudinal variations of the vortex vector were measured over the half channel width using a vortex sonde calibrated by rotation in a known flow. Transversal correlation measurements with two vortex sondes indicate a mean distance of delta z(+) approximately 50 between low and high speed streaks. Counter rotating vortex-like structures were also observed up to wall distances of y(+) approximately 30. The mean distance between these structures is also delta z(+) approximately 50. ESA

N77-31457# Loughborough Univ. of Technology (England). Dept. of Mathematics.

THE DISTORTION OF A CROSSED MAGNETIC FIELD BY THE FLOW OF AN INVISCID CONDUCTING FLUID PAST

A SPHERE
R. Smith Mar. 1976 25 p refs
(MATHS-Res-95) Avail: NTIS HC A02/MF A01

The flow of an inviscid incompressible fluid past a nonconducting sphere was considered for cases in which the ratio of the magnetic to dynamic pressure beta is small, which implies that the velocity field is only slightly distorted from its value when the fluid is nonconducting. The magnetic Reynolds number, Rm is assumed small, in the first part of the analysis; however, a solution for infinite Rm is also given. The method of solution for small Rm, more specifically 0 less than or equal to beta less than or equal to Rm, less than or equal to 1, is to develop an inner Stokes expansion near the sphere and an outer Oseen expansion valid at great distances. ESA

N77-31458# National Physical Lab., Teddington (England). Div. of Chemical Standards.
NEW SIMPLIFIED METHODS FOR THE ESTIMATION OF THE VISCOSITIES OF GAS MIXTURES AT MODERATE PRESSURES
D. Reichenberg May 1977 61 p refs
(NPL-Chem-53) Avail: NTIS HC A04/MF A01

Three methods are presented for estimating the viscosity of gas mixtures at moderate pressures where the viscosity is virtually independent of pressure. The mathematical formulation together with estimating procedures and relevant computer programs are detailed. The general background with the derivation of the new methods are given together with comparative tests with some existing methods. ESA

N77-31459# Cambridge Univ. (England). Dept. of Engineering.
COMPRESSIBLE TURBULENT BOUNDARY LAYERS WITH DISCONTINUOUS AIR TRANSPIRATION: AN EXPERIMENTAL AND THEORETICAL INVESTIGATION Ph.D. Thesis
P. G. Marriott London Aeron. Res. Council 1977 98 p refs Supersedes ARC-35398 Sponsored by Min. of Technol.
(ARC-R/M-3780; ARC-35398) Avail: NTIS HC A05/MF A01; HMSO £8; PHI

Experimental data are presented for the development of compressible turbulent boundary layers moving from a solid into a transpired surface, and vice versa. The data were obtained at free stream Mach numbers of 1.8 and 3.6 (Reynolds numbers per meter of 2.45x10 to the 7th power and 5.45x10 to the 7th power respectively) and transpiration rates up to 0.0044, for nominally zero heat-transfer conditions. The results are compared with theoretical predictions obtained from a method based on the eddy-viscosity concept. Author (ESA)

N77-31460# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A NUMERICAL INVESTIGATION OF THE THICKENING OF A SHOCK WAVE ON PASSING THROUGH TURBULENCE
J. A. Beasley London Aeron. Res. Council 1977 25 p refs Supersedes RAE-TR-74131; ARC-35953
(ARC-R/M-3793; RAE-TR-74131; ARC-35953) Avail: NTIS HC A02/MF A01; HMSO £3.50; PHI

The characteristic 'N' shaped pressure waves recorded at ground level below the flight path of supersonic aircraft have compressive regions very much less steep than predicted by theory, with a consequent reduction in a subjective annoyance. Attempts were made to explain this phenomenon in terms of the effect of atmospheric turbulence. This report is concerned with the particular proposal that since on passing through turbulence a shock will tend to become thicker for part of the time and to steepen for the remainder then if the thickening process operates faster than the steepening a net increase in thickness will result. The problem is simulated in one-dimension by a variation of the 'piston-problem' in which pressure waves representing turbulence are made to pass through a shock wave. The governing partial differential equations are solved using a finite difference technique. The results of the calculations show that a shock wave tends to become thicker on passing through a disturbance wave having equal positive and negative parts. This is consistent with the proposed explanation of a shock thickening although the thickening calculated is small compared to the initial shock thickness, for the disturbance waves used. Distortion of the disturbance waves with the time prevented a wider study of the effects of a varying amplitude and wavelength being made so that precise quantitative conclusions could not be drawn but it is suggested that the process investigated is unlikely to be powerful enough to produce the shock thickening measured experimentally in sonic boom research. Author (ESA)

N77-31461# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESOLUTION OF THE NAVIER-STOKES EQUATIONS BY A FINITE ELEMENT METHOD Ph.D. Thesis - Paris 6 Univ.
Michel Borrel Jun. 1977 118 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-425)
(ONERA-NT-1977-8) Avail: NTIS HC A06/MF A01

A finite element method for the numerical calculation of viscous, incompressible, laminar flows, from the steady Navier-Stokes equations, is studied both theoretically and as regards its implementation. In a first part, the mathematical frame of the Navier-Stokes equations being set, the principle of the method is presented, as well as a study of convergence and of estimation of the approximation error. In a second part, the implementation of the various parts of the computing program is presented, as well as numerical results obtained for flows at various Reynolds numbers: 1. in a square cavity, 2. within a domain around the trailing edge of an aerfoil and including a zone where the boundary layer approximation is no more valid. An appendix gives the calculation of an incompressible ideal flow around an aerfoil at incidence, first step of an iterative process based on the determination and coupling of several calculation zones.
Author (ESA)

N77-31462# Naval Postgraduate School, Monterey, Calif.
HEAT TRANSFER PERFORMANCE OF VARIOUS ROTATING HEAT PIPES M.S. Thesis
Lawrence Lee Wagenseil Dec. 1976 63 p refs
(AD-A039375) Avail: NTIS HC A04/MF A01 CSCL 13/1

A rotating heat pipe was tested using various copper condenser configurations including two smooth-wall cylinders, an internally finned cylinder and a truncated cone. All condensers were tested with film condensation, and the truncated cone was also tested for dropwise condensation. Each condenser was tested at rotational speeds of 700, 1400 and 2800 RPM with distilled water as the working fluid. The heat transfer rate of each condenser was plotted against the saturation temperature of the vapor. The main objective was to compare the heat transfer rates obtained with the various condensers in order to identify an optimum configuration for future testing. In all cases, performance improved with increasing RPM. Dropwise condensation showed substantial improvement in performance relative to film condensation in the same condenser. Similarly, the performance of the internally finned cylindrical condenser was remarkably superior to that of the smooth-wall cylindrical condenser.
Author (GRA)

N77-31463# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF GRAVITY ON GAS-LOADED VARIABLE CONDUCTANCE HEAT PIPES Final Report, FY 1975 - 1976
Matthew D. Kelleher 25 Mar. 1977 62 p refs
(Grant NSF AG-496)
(AD-A039185; NPS-69Kk77031) Avail: NTIS HC A04/MF A01 CSCL 13/1

The effects of gravity on the operation of gas-loaded variable conductance heat pipes have been investigated. Experimental results have been obtained for three heat pipes (1.6 cm, 2.5 cm and 5 cm diameter) operating with methanol or Freon 113 as the working fluid and krypton or helium as the control gas. Results show that gravity tends to distort the axial temperature profiles on the small diameter pipe. For the large diameter pipe gravity has the effect of causing a stratification of the working fluid and non-condensible gas. These results seem to indicate that in certain cases the presently available design procedure will have to be modified to account for the effects of gravity on variable conductance heat pipe operation.
Author (GRA)

N77-31464# Pennsylvania State Univ., University Park. Applied Research Lab.

NOISE DUE TO THE INTERACTION OF BOUNDARY LAYER TURBULENCE WITH A MARINE PROPULSOR OR AN AIRCRAFT COMPRESSOR M.S. Thesis
Neil Moiseev, B. Lakshminarayana, and D. E. Thompson 11 Oct. 1976 124 p refs
(Contract N00017-73-C-1418)
(AD-A040946; TM-76-258) Avail: NTIS HC A06/MF A01 CSCL 20/1

The sound generated by the interaction of inlet boundary layer turbulence with a rotating blade row is investigated. To experimentally study this radiated sound, an existing aeroacoustic facility was modified to produce the inflows desired. The rotor was operated in air with different blade space-to-chord ratios, different flow coefficients and different anisotropic, nonhomogeneous turbulent inflows. The inflows ingested are: (1) natural boundary layer on hub and annulus wall, (2) a tripped boundary layer on the hub, and (3) a fully developed boundary layer on the hub. The turbulence intensities and length scales were altered by placing a grid at the inlet. The sound pressure level is found to be directly proportional to the turbulence intensity squared and inversely proportional to the ratio of axial length scale to blade spacing. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-31465* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REAL TIME REFLECTOMETER Patent
James M. Zwiener, inventor (to NASA) Issued 9 Aug. 1977 10 p Filed 28 May 1976 Supersedes N76-26446 (14 - 17, p 2189)
(NASA-Case-MFS-23118-1; US-Patent-4,040,750; US-Patent-Appl-SN-691256; US-Patent-Class-356-212) Avail: US Patent Office CSCL 14B

A real time reflectometer with the particular utility of measuring fairly rapid (transient) changes in the specular reflectance of a sample which is continuously exposed to a perturbing environment is described. A fixed radiation source, a fixed detector, a uniformly rotating sample wheel, and a uniformly rotating optical wheel protect against misalignment problems. The reflectometer operates by comparing the measurings of a reflected signal with that of a reference signal made within fractions of a second of one another. Reflectance is measured in the infrared, visible, and vacuum ultraviolet regions.
Official Gazette of the U.S. Patent Office

N77-31466# Stanford Univ., Calif. Guidance and Control Lab.
STUDY TO DEVELOP GRADIOMETER COMPENSATION TECHNIQUES Final Report, Aug. 1975 - Jul. 1976
Daniel B. DeBra and Eugene J. Pelka Dec. 1976 36 p refs
(Contract F19628-76-C-0109; AF Proj. 8607)
(AD-A039893; AFGL-TR-77-0038) Avail: NTIS HC A03/MF A01 CSCL 08/5

There are three moving base gravity gradiometers currently under development. The instruments are being develed at the Hughes Research Labs, the Bell Aerospace Corp., and the Charles Stark Draper Lab. The Design goal for each of the sensors is 1 Eotvos Unit (EU). The group includes sensors designed specifically to measure the gravity gradient, as well as sensors which utilize existing accelerometers to provide a gradient estimate. The Hughes and Bell instruments rotate, modulating the information. This rotation transfers the gravity gradient signal to a higher frequency, quieter, portion of the spectrum, and can separate the signal from some sources of instrument bias. The Draper Lab. sensor measures the gradient signal at zero frequency and uses a sophisticated flotation suspension system to isolate the sensing element from errors induced by rotation and jitter. A system of at least three instruments of any one type is required in order to provide a complete gravity gradient tensor estimate. The primary objective of this paper is to define the optimal relative orientations of the three sensors which comprise a minimum gravity gradient measurement system. In addition, the effects of different relative sensor orientations when a fourth, redundant sensor is included, are considered. GRA

N77-31467# Wisconsin Univ., Milwaukee. Dept. of Geological Sciences.
MARINE GEOPHYSICAL INSTRUMENTATION Final Report, 1 Apr. 1970 - 30 Jun. 1976
Richard J. Old 31 Dec. 1976 117 p refs
(Contract N00014-67-A-0128-0016)
(AD-A040048) Avail: NTIS MF A01 CSCL 17/10

In 1970, development was started on three marine geophysical instrumentation systems: a seismic recording and display system; a digital magnetometer system; and a magnetometer-gradiometer velocity system. In 1974, development was started on a Hydraulic-Pneumatic Water Gun. This report summarizes the development effort on each of these systems. Author (GRA)

N77-31468# C and C Research, Inc., Danvers, Mass.
HIGH RESOLUTION CPA STUDY Final Technical Report, Feb. 1976 - Feb. 1977
M. R. Cole and R. P. Czwakiel Griffiss AFB, N. Y. RADC Apr. 1977 49 p refs
(Contract F30602-76-C-0169)
(AD-A040224; RADC-TR-77-146) Avail: NTIS HC A03/MF A01 CSCL 14/5

Concurrent Photon Amplification (CPA) was originally developed as a technique for increasing the effective film speed of materials for use under low light conditions. It has now been successfully adapted for use in high resolution photography. By applying CPA techniques to slow-speed high-resolution film materials, these may be used to replace conventional films so as to provide photographic collection systems with at least twice as much resolution while working in the exposure index range from 32 to 1600. Experiments conducted show that Kodak PAN-X film, with a speed of 32 and a resolution capability of approximately 80 line pairs per millimeter, can be replaced by KODAK 5069 in combination with Concurrent Photon Amplification and special processing to yield a photographic system resolution over 200 line pairs per millimeter and an effective film speed of 100 or more. In a similar fashion, Kodak TRI-X film with a speed of 400 and resolution capability of about 40 line pairs per millimeter can be replaced by a high resolution system based on Kodak 2496 film, CPA and special processing. This system provides resolution over 100 line pairs per millimeter and effective film speeds in the 800 to 1000 range. The CPA high resolution photographic system offers an additional advantage of increasing the resolution latitude, so that a given level of resolution is attained over a wider range of exposures; thereby increasing the probability of mission success. Author (GRA)

N77-31469# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPOSITE SEMICONDUCTOR BOLOMETERS FOR THE DETECTION OF FAR-INFRARED RADIATION M.S. Thesis
Norman S. Nishioka Dec. 1976 59 p refs
(Contract W-7405-eng-48)
(LBL-5774) Avail: NTIS HC A04/MF A01

A composite semiconductor bolometer for the detection of far-infrared radiation was developed in which doped germanium serves as the temperature sensor and a bismuth coated sapphire substrate serves as the radiation absorber. Metal wires serve as the thermal and electrical conductance to the environment. These detectors operate at pumped liquid He-4 temperatures (approximately 1.3 K). In many applications these detectors approach the theoretical limits of sensitivity. Optimization calculations have been performed which predict both the ultimate performance possible from these detectors as well as the optimum operating conditions in various experimental situations. ERA

N77-31470# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
CDIF INSTRUMENTED TEST SECTION

G. Bethke, T. Burton, D. Dedominicis, and A. Sterk 18 Aug. 1976 238 p refs
(Contract W-31-109-eng-38)
(TID-27148) Avail: NTIS HC A11/MF A01

The work performed on a conceptual design of an instrumented test section for the Component Development Integration Facility (CDIF) at Butte, Montana for the ERDA coal-fired MHD development program is summarized. Topics discussed include facilities requirements, channel design, optical and light scattering diagnostics, temperature measurement, conductivity cell, sampling probe measurements, advanced technology concepts, recommended development tasks, and program plan. The four instrumentation systems (DDS laser velocimeter, line reversal temperature measurement, conductivity probe, and diagnostic probes) are described in detail. ERA

N77-31471# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
METALLIZE SLURRY VISCOMETER
T. J. Gillespie 12 Jan. 1977 12 p
(Contract EY-76-C-04-0656)
(GEPP-234) Avail: NTIS HC A02/MF A01

A device for controlling metallized slurry viscosity is described. The device also provides uniform milling of the slurry and retards solvent evaporation. It consists of a rotating cylindrical channel, a steel roller and a mechansim to indicate the angular position of the roller. A change in slurry viscosity is indicated by a change in the angular position of the roller. Control of the metallized viscosity is achieved by adding solvent to the slurry in the channel when the roller scale approaches the predetermined upper viscosity limit. ERA

N77-31472# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
IRON-FREE MOVING COIL HIGH TEMPERATURE DISPLACEMENT TRANSDUCER
A. Grindrod Jul. 1976 29 p
(RD/B/N-3647) Avail: NTIS (US Sales Only) HC A03/MF A01

A system is described which is suitable for continuously monitoring linear movements at varying temperatures up to 750 C in operational nuclear reactors. This system has uses where long term measurements on conventional high temperature plants are required. It is particularly useful in material creep laboratories where precise linear changes in specific length need to be monitored at elevated temperatures over several years. ERA

N77-31473# Committee on Space Research (COSPAR), Paris (France).
HOW TO USE TRANSPARENT DIAZO COLOUR FILM FOR INTERPRETATION OF LANDSAT IMAGES
O. G. Malan (Natl. Phys. Res. Lab., Pretoria) Jan. 1976 46 p Original contains color illustrations
(Tech-Man-Ser-6) Avail: NTIS HC A03/MF A01

This manual is aimed at potential users of LANDSAT data with some basic training in scientific disciplines such as agricultural extension officers, foresters, geologists, etc. without special training in photographic darkroom techniques. Procedures are described which enable the investigator to enhance those features in the Landsat images of most interest to him and to facilitate his task of correlating data from unknown areas with those more familiar to him. No particular color combination can be recommended which will be universally applicable and it must be left to the discretion of the investigator to select the most suitable color combination for this particular area and discipline. ESA

N77-31474# Air Force Weapons Lab., Kirtland AFB, N.Mex.
AFWL SCANNING INTERFEROMETER Final Report
Dave Holmes, Burton D. Neill, and Roy L. Parnell Jan. 1977 40 p refs
(AD-A036501; AFWL-TR-76-268) Avail: NTIS HC A03/MF A01 CSCL 20/6

A method has been developed for determining the Optical Transfer Function of a coherent optical system by edge scanning a focused output sample of the system across a detector to obtain the Edge Response Function. This Function is then electronically differentiated and Fourier Transformed to yield the Optical Transfer Function and the Point Spread Function. Experimentally generated Edge Response Functions, Line Spread Functions, Optical Transfer Functions, and Point Spread Functions were compared to theoretical predictions for a laboratory HeNe optical system and excellent agreement was obtained. Applications of this technique to laser beam control systems are discussed. GRA

N77-31475# New York Univ. Medical Center. Inst. of Environmental Medicine.
PERSONAL SAMPLERS FOR CO, NO AND NO2 IN AIR Final Report
E. D. Palmes Mar. 1977 22 p refs
(Grant G0133066)
(PB-267232/7; BM-OFR-92-77) Avail: NTIS HC A02/MF A01 CSCL 14B

An NO2 sampler which is small, inexpensive, and lightweight, and which is suitable for use as a personal sampler to be worn by miners while at work is described. The sampler utilizes the principle of molecular diffusion for the transfer of the NO2 from the environment to a collecting medium through a well-defined diffusion barrier. The sampler performed satisfactorily both in the laboratory and in the field. Work was begun on samplers for NO and CO but no absorbents tested for these gases during the grant period were demonstrated to be adequate. GRA

N77-31194*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN WATER VAPOR RADIOMETER DEVELOPMENT: RECENT WORK Summary, 1976 - 1977
S. D. Slobin and P. D. Batelaan *In its* The Deep Space Network 15 Aug. 1977 p 71-75 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-31476*# Illinois Univ., Urbana. Radio Research Lab.
CORRECTION OF LASER RANGING DATA FOR THE EFFECTS OF HORIZONTAL REFRACTIVITY GRADIENTS Final Report
C. S. Gardner and B. E. Hendrickson Dec. 1976 83 p refs
(Grant NsG-5049)
(NASA-CR-152575; UILU-ENG-77-2539; RRL-478) Avail: NTIS HC A05/MF A01 CSCL 20E

A formula has been developed to correct laser ranging data for the effects of horizontal refractivity gradients. The formula requires the values of the horizontal pressure and temperature gradients at the laser site. The accuracy of this technique was evaluated by comparing the formula with range corrections which were computed by ray tracing. Author

N77-31477# ARO, Inc., Arnold Air Force Station, Tenn.
LASER VELOCIMETER UTILIZATION IN JET ENGINE ALTITUDE TEST CELLS Final Report, Oct. 1975 - Jun. 1976
D. O. Barnett AEDC Jun. 1977 36 p refs
(AD-A041019; ARO-ETF-TR-76-147; AEDC-TR-77-21) Avail: NTIS HC A03/MF A01 CSCL 14/2

The feasibility of utilizing a laser velocimeter (LV) in turbine engine testing in an altitude test cell was investigated. A one-component LV and associated environmental control system (ECS) were designed, fabricated, and installed in Test Cell J-2 of the Engine Test Facility (ETF). LV measurements made on the centerline of an F101 engine at one axial station downstream of the nozzle exit are presented and compared to the calculated exit velocity. Design data are presented on the vibration levels and temperatures encountered by the LV over a range of engine operating conditions. It was found that sufficient natural seed material existed in the exhaust flow to allow the LV to characterize the exit velocity of a turbojet engine during altitude testing. Author (GRA)

N77-31478# ARO, Inc., Arnold Air Force Station, Tenn.
A LASER VELOCIMETER FOR THE AEDC ACOUSTIC

RESEARCH TUNNEL Final Report, 11 Oct. 1974 - 30 Jun. 1976
V. A. Cline Jun. 1977 32 p refs
(AD-A040903; ARO-PWT-TR-77-53; AEDC-TR-77-53) Avail: NTIS HC A03/MF A01 CSCL 14/2

An operational laser velocimeter (LV), installed in the Acoustic Research Tunnel (ART) at the Arnold Engineering Development Center (AEDC), for routine measurement of mean flow velocities, flow angle, and turbulent intensity is described. It is a two component, dual-scatter, moving-fringe-type system collecting forward-scattered radiation. Basic LV theory and one of the foremost problems of application (particle lag) are discussed in some detail. Test data compared with conventional measurements of velocity and flow angle are shown. Author (GRA)

N77-31479# Laser Diode Labs., Inc., Metuchen, N. J.
INJECTION LASER DIODES FOR FIBER OPTIC COMMUNICATIONS Quarterly Report, 30 Sep. - 31 Dec. 1976
Thomas E. Stockton 27 Apr. 1977 83 p
(Contract DAAB07-76-C-0040)
(AD-A040481; QR-2) Avail: NTIS HC A05/MF A01 CSCL 20/5

The design and fabrication of injection laser diodes for use in fiber optic communications is discussed with regard to material synthesis, chip configuration, and device assembly in the manufacturing environment. The opto-electronic source is based on the GaAs-GaAlAs double heterojunction structure and consists of a parallel array of lasers formed by the application of triple stripe geometry to the surface of the epitaxial wafer. The monolithic triad of discrete lasing elements is mounted in a high frequency package which incorporates a high quality optical window. Author (GRA)

N77-31480# Naval Research Lab., Washington, D. C. Plasma Physics Div.
PROTON BEAM PUMPING OF HIGH PRESSURE GAS LASERS Interim Report
A. W. Ali May 1977 13 p refs
(AD-A040689; NRL-MR-3519) Avail: NTIS HC A02/MF A01 CSCL 20/5

The application of proton beams of excite lasers, from gaseous elements under high pressure is proposed. It is pointed out that, using proton beams, higher laser power density can be obtained compared with current e-beam excited lasers. Author (GRA)

N77-31481# Northrop Research and Technology Center, Hawthorne, Calif.
KINETIC STUDIES OF THE KRF LASER Final Technical Report, 20 Mar. - 28 Feb. 1977
W. B. Lacina, R. S. Bradford, Jr., and M. L. Bhaumik Mar. 1977 69 p
(Contract N00014-76-C-0777)
(AD-A040826; NRTC-77-29R) Avail: NTIS HC A04/MF A01 CSCL 20/5

The small signal gain coefficient for KrF in a high pressure, e-beam excited mixture of Ar/Kr/F2 has been measured at different pressures using an oscillator-amplifier configuration. Kinetic modeling of the electrically excited KrF laser system has been carried out using a sophisticated and comprehensive computer analysis which couples molecular and electron kinetics, radiative extraction, and external driving circuit. Comparisons of the results of kinetic modeling with small signal gain measurements have been made, and reasonable agreement is obtained. Author (GRA)

N77-31482# Naval Surface Weapons Center, White Oak, Md.
CONDENSED FUELS FOR HIGH ENERGY GAS DYNAMIC LASERS Final Report, period ending Jun. 1976
G. B. Wilmot, E. G. Powell, H. S. Haiss, R. C. Gill, and O. H. Dengel Aug. 1976 51 p refs
(WR0240301)
(AD-A040932; NSWC/WOL/TR-77-51) Avail: NTIS HC A04/MF A01 CSCL 20/5

The conventional gas dynamic laser is driven by a gas mixture consisting of approximately 85% N2, 10% CO2 and 5% H2O. The formulation of all solid fuels which generate such a gas mixture at the required temperatures and rates is beyond reach. Investigations were conducted to determine the small signal gain of gas compositions amenable to all solid gas generator formulating. It was found that acceptable gains can be achieved when N2 is partially replaced by CO and H2O by HCl. Based on these results a solid composition was formulated and tested which gave 28% CO, 10% CO2, 16% HCl and 46% N2. Author (GRA)

N77-31483# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
LORENTZ BROADENING IN THE MODELING OF THE HF CHEMICAL LASER Interim Report
Joseph J. T. Hough 8 Jun. 1977 61 p refs
(Contract F04701-76-C-0077)
(AD-A040972; TR-007(2604)-1; SAMSO-TR-77-109) Avail: NTIS HC A04/MF A01 CSCL 20/5

The results of a survey of pressure-broadening data in the literature, pertaining to species present in H2-F2 chemical lasers are described. Pressure-broadened linewidths of the HF vibration/rotation transitions were found to depend strongly on the vibrational and rotational quantum numbers, as well as on the perturbing species. The experimental data were incorporated into a rate equation model of the pulsed H2-F2 laser; where experimental data were unavailable, theoretical values were used. The calculations made from this model demonstrate the importance of including such detailed pressure-broadening information. Recent experimental results of Kwok and Cohen for HF V yeilds R, T deactivation was also included in the model and was taken to be a multiquantum process. Comparisons of model predictions for pulse energy and pulse duration with several atmospheric-pressure laser measurements showed good agreement. Author (GRA)

N77-31484# Harry Diamond Labs., Adelphi, Md.
SMALL, HIGH REPETITION-RATE HF AND DF LASERS
Walter A. Riessler and Colin S. Willett May 1977 31 p refs
(DA Proj. 1T1-62114-AH-73)
(AD-A040993; HDL-TR-1813) Avail: NTIS HC A03/MF A01 CSCL 20/5

Measurements are presented of the multiline spectral output, output power as a function of pulse-repetition rate, and V-I (voltage-current) characteristics of small pulsed hydrogen fluoride (HF) and deuterium fluoride (DF) lasers that have been operated at repetition rates up to 1 kHz. Results indicate that observed reductions in output power at high repetition rates are due to an insufficient gas flow that (1) allows the ground state population to build up, (2) reduces population inversion between the first vibrational state and the ground state, and (3) introduces discharge instabilities that severely limit the pulse-rate capabilities. Average powers are reported to vary linearly with pulse-repetition rate up to 400 Hz, with typical pulse energies of 10 and 4 mJ for small HF and DF lasers respectively with discharge lengths of only 10 cm. Author (GRA)

N77-31485# Alabama Univ., Huntsville. School of Science and Engineering.
INVESTIGATION OF TRANSIENT FLOW AND HEATING PROBLEMS CHARACTERISTIC OF HIGH ENERGY LASER GAS CIRCULATION SYSTEMS Final Technical Report, 3 Feb. 1976 - 31 Mar. 1977
Cornelius C. Shih and Gerald R. Karr Mar. 1977 167 p refs
(Contract DAAK40-76-C-0474)
(AD-A041040; UAH-RR-199; DRDMI-H-CR-77-9) Avail: NTIS HC A08/MF A01 CSCL 20/5

As a parallel effort to the program initiated to design and fabricate a small scale closed cycle circulator for repetitively pulsed electric discharge lasers at 200 K temperature and high pressures, this investigation was initiated to obtain the fundamental knowledge of fluid and thermal characteristics of the recirculating gas flow in the closed cycle circulator during the pulsed laser operation. GRA

N77-31486# Physical Sciences, Inc., Woburn, Mass.
RADIATION-INDUCED SOUND Final Report, 15 Mar. - 30 Dec. 1976
P. E. Nebolsine Jan. 1977 72 p refs
(Contract N00014-76-C-0693; NR Proj. 261-206)
(AD-A040437; PSI-TR-82) Avail: NTIS HC A04/MF A01 CSCL 20/5

Radiation-induced-sound experiments were conducted with one to four 10.6 micrometer CO2 laser pulses. These experiments were conducted to demonstrate the ability to control the acoustic energy spectral density. The acoustic signatures were Fourier analyzed to obtain the energy spectral density. The results show that the ratio of the width of a peak in the spectrum to the fundamental frequency scales approximately as the inverse of the number of pulses. This scaling does not hold if the pulses are not evenly spaced or not even in amplitude. Theoretical modeling formulated scaling laws relating laser parameters to acoustic parameters of the generated signatures. Theoretical predictions were also made of the change in amplitude and shape of the broadband signals due to frequency-dependent absorption as a function of propagation distance. Author (GRA)

N77-31487# United Technologies Research Center, East Hartford, Conn.

INVESTIGATION OF PLASMA PROCESSES IN ELECTRONIC TRANSITION LASERS Annual Report, 1 Jun. 1976 - 1 Jul. 1977

William L. Nighan and Robert J. Hall 1 Jul. 1977 72 p refs
(Contract N00014-76-C-0847)
(AD-A041520; UTRC/R77-922617-2) Avail: NTIS HC A04/MF A01 CSCL 20/5

Plasma processes in electrically excited rare gas-halide lasers have been investigated theoretically, with particular emphasis on the KrF system. These studies have resulted in the identification of fundamental processes influencing electron energy transfer, charged particle production and loss, metastable production and loss, and plasma stability. Both electron beam pumped and discharge pumped lasers have been examined. In addition, resonance scattering theory has been applied to available e-F2 attachment data in order to determine electron cross-sections for F2 dissociative attachment and vibrational excitation. Estimates of direct electron impact dissociation of F2 have also been made. Author (GRA)

N77-31488# United Technologies Research Center, East Hartford, Conn.

LONG RANGE CHAIN LASER STUDIES, PHASE 1 STUDIES Final Report

L. R. Boedeker, P. A. Bonzyk, J. J. Hinchen, R. Tripodi, and C. J. Ultee Jun. 1977 314 p refs
(Contract F29601-75-C-0139; AF Proj. 2761)
(AD-A041204; UTRC/R77-952198-58; AFWL-TR-77-43) Avail: NTIS HC A14/MF A01 CSCL 20/5

The chemical and vibrational kinetics of the H2-F2 chain reaction were studied to improve the description of the evolution of the various vibrational levels in order to better predict chain-reaction-laser performance. Two types of experiments were performed: (1) flow tube, and (2) pulsed reaction. In the flow tube experiments, fluorine atoms were produced by passing F2 through a mass heater. The F2 and F emanating from the heater were mixed with additional F2, Ar, and H2 to achieve the desired stoichiometry. GRA

N77-31489# Alabama Univ., Huntsville.

NEW MATERIALS FOR CHEMICAL LASER WINDOWS Final Report, Jun. - Dec. 1976

James A. Harrington, Don A. Gregory, Herbert B. Rosenstock, and M. Hass Feb. 1977 56 p refs
(Contract N00014-76-C-0941)
(AD-A041215; UAH-RR-198) Avail: NTIS HC A04/MF A01 CSCL 20/5

Many of the more common materials such as the alkaline earth fluorides, ZnSe, and the alkali halides have been studied for use as low loss windows on DF-HF chemical lasers yet there remain others which have received little or no attention at these wavelengths. We have begun to investigate some of these other materials in hopes of finding additional low absorbing materials which show potential as laser windows. GRA

N77-31490# Ohio State Univ., Columbus. ElectroScience Lab.

CO PROBE LASER FOR ATMOSPHERIC STUDIES Final Report

Edward K. Damon and Michael E. Thomas May 1977 18 p refs
(Contract N00123-76-C-0233)
(AD-A041528; ESL-4430-1) Avail: NTIS HC A02/MF A01 CSCL 20/5

The design, construction, and test of a CO probe laser is discussed. An electrically excited, flowing gas system was used. Output power of 360 mW was achieved in the 5-4 band, and 25 mW in the 3-2 band. Author (GRA)

N77-31491# Space and Missile Test Center, Patrick AFB, Fla.

LASER RANGING ON TEST 7688

John M. Kennedy 1 Mar. 1977 11 p refs
(AD-A041082; SAMTEC/DET1-TR-77-03) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report presents the results of a test of the Laser Ranging system against the launch of a Trident missile coated with a band of reflective paint. Four consecutive laser hits at one second intervals were recorded and compared favorably, metrically, to the Best Estimate of Trajectory for this launch. Author (GRA)

N77-31492# California Univ., Livermore. Lawrence Livermore Lab.

MULTI-LEVEL PULSED CHEMICAL LASER MODEL

Bill P. Curry and R. E. Kidder 11 Jul. 1972 48 p refs
(Contract W-7405-eng-48)
(UCRL-74024) Avail: NTIS HC A03/MF A01

Short-pulsed chemical lasers were analyzed with regard to establishing diagnostic relations and determining limits on laser performance. Time dependent population inversions incorporating the effects of collisional deactivation, stimulated emission, and chemical source variation were determined using a rigorous matrix procedure. These inversions were combined with a radiative rate equation and the resulting output intensity profiles and total energy density were evaluated for three types of source variations: (1) constant source strength, (2) exponentially varying source strength, and (3) chain reaction source. The effect of chemical branching on laser performance was investigated by using a positive exponential. A negative exponential is used to determine the effect of a declining free radical population (incomplete chain reaction) on laser performance. Both collisional deactivation and free radical decline were shown to have deleterious effects on laser output and chemical efficiency, as compared to earlier, more optimistic estimates. ERA

N77-31493# Sandia Labs., Albuquerque, N. Mex.

DENSITY AND TEMPERATURE MEASUREMENTS WITH LASERS

A. Wayne Johnson and J. B. Gerardo Feb. 1977 31 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0728) Avail: NTIS HC A03/MF A02

Simultaneous two-photon gain/loss measurements (SITOP) and sequential two-photon gain/loss measurements (SETOP), are described. Each require two lasers for monitoring species densities in gas-phase chemical reactions. The techniques are compared to the single-laser resonance-fluorescence method. In many combustion environments the techniques, SITOP and SETOP, may be used to determine densities that are impractical to determine with the resonance-fluorescence method. While SITOP and SETOP are more complicated experimentally, these techniques may be the only method for monitoring chemical reactions in many combustion devices. ERA

N77-31494# California Univ., Livermore. Lawrence Livermore Lab.

LASER FUSION EXPERIMENTS AT 2 TW

E. K. Storm, H. G. Ahlstorm, and M. J. Boyle 1 Oct. 1976 31 p refs Presented at Plasma Phys. meeting of the Amer. Phys. Soc., San Francisco, 15 Nov. 1976
(Contract W-7405-eng-48)
(UCRL-78581-Rev-2; Conf-761108-24) Avail: NTIS HC A03/MF A01

Laser implosion experiments were performed at power levels exceeding 2 TW. The D-T filled glass microspheres were imploded to yield thermonuclear reaction products in excess of 500 million. Neutron and alpha time-of-flight measurements indicate that D-T ion temperatures of approximately 5-6 keV and a density confinement time product (n tau) of approximately 1 x 10 to the 12th power were obtained. An extensive array of diagnostics routinely monitored the laser performance and the laser target

interaction process. Measurements of absorption and asymmetry in both the scattered light distribution and the ion blow off is evidence for nonclassical absorption mechanisms and density scale heights of the order of 2 micrometers or less. The symmetry of the thermonuclear burn region is investigated by monitoring the alpha particle flux in several directions, and an experiment to image the thermonuclear burn region is in process. ERA

N77-31495# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
HEAT-PIPE BISMUTH LASER; EXAMINATION OF LASER ACTION AT 4722 A IN BISMUTH VAPOR Final Report, 1 May 1973 - 31 Jan. 1975
William T. Walter and Nicholas Solimene Nov. 1976 69 p refs
(Contract N00014-67-A-0438-0015)
(AD-A039568; POLY-EE/EP-76-022) Avail: NTIS HC A04/MF A01 CSCL 20/5

The possibility of producing efficient pulsed laser action at 4722A in the neutral atomic vapor of bismuth has been examined. The presence of a substantial fraction of dimers (Bi2 molecules) in the vapor of bismuth could prevent laser action by absorption of the 3067A Bi resonance line. This would not only reduce radiation trapping but would also produce dissociation of the dimers leaving one Bi atom in a metastable proposed lower laser level. Heat pipes were used to create a two temperature zone apparatus and thermally dissociate bismuth dimers. Double-pulses were used to produce discharge dissociation of bismuth dimers. The pressure and composition of bismuth vapor has been critically evaluated. A radial discharge was used to reduce the risetime of the excitation current pulse to approximately 25 nsec which is much shorter than the reciprocal of 5,300,000 sec, the best value for the 4722A transition probability. Absence of laser action at 4722A is believed due to competing processes within the bismuth atom. GRA

N77-31496# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
LASER DAMAGE IN SEMICONDUCTORS Final Report
S. K. Gulati and W. W. Grannemann Mar. 1977 124 p refs
(Contract F44620-75-C-0077)
(AD-A039135; EE-245(77)AFOSR-379-1; AFOSR-77-0625TR)
Avail: NTIS HC A06/MF A01 CSCL 20/12

Experimental damage thresholds for Si, Ge, GaAs, GaAs(x)P (1-x) and GaP have been determined at 10.6 x 10 to the -6 and 1.06 x 10 to the -6 laser wavelengths. For CW CO(2) laser damage, all the thresholds are of the order of a few kW/cm(2) for an irradiation time of about 0.10 second. At 1.06 x 10 to the -6 wavelength and for nanosecond pulses, the damage thresholds are of the order of 10(9) W/cm(2). The damage thresholds can be explained by assuming that the anomalous absorption takes place through the parametric instability of the type formulated by DuBois and Goldman. The plasma concentration required for the onset of this instability at 10.6 x 10 to the -6 is easily achieved by photon induced excitation of the valence electrons to the conduction band through a continuous distribution of Shockley surface states. At 1.06 x 10 to the -6, the required plasma concentration in case of Germanium and Silicon is produced by band to band transitions and by Zener tunneling in case of GaAs, GaAs(x)P(1-x) and GaP. In practice the damage occurs both at the surface of the semiconductor and within the bulk, creating defects that cause carrier removal and mobility degradation. The defects so created are more active at lower temperatures than at room temperature as seen from the experimentally measured Hall mobility versus temperature curves before and after laser damage. Carrier removal and mobility degradation curves appear qualitatively to be similar to those observed for electron, neutron and X-ray damage. GRA

N77-31195*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN MASER FREQUENCY STANDARDS FOR THE DEEP SPACE NETWORK
P. R. Dachel, S. M. Petty, R. F. Meyer, and R. L. Sydnor *In its* The Deep Space Network 15 Aug. 1977 p 76-83 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-31497* National Aeronautics and Space Administration. Pasadena Office, Calif.
COMBUSTION ENGINE Patent
John Houseman, inventor (to NASA) (JPL) Issued 16 Aug. 1977 9 p Filed 2 Apr. 1975 Supersedes N77-17467 (15 - 08, p 1040) Sponsored by NASA
(NASA-Case-NPO-13671-1; US-Patent-4,041,910; US-Patent-Appl-SN-564622; US-Patent-Class-123-59E; US-Patent-Class-123-3; US-Patent-Class-123-37; US-Patent-Class-123-119A; US-Patent-Class-123-122AB; US-Patent-Class-123-DIG.8) Avail: US Patent Office CSCL 21E

An arrangement for an internal combustion engine is provided in which one or more of the cylinders of the engine are used for generating hydrogen rich gases from hydrocarbon fuels, which gases are then mixed with air and injected into the remaining cylinders to be used as fuel. When heavy load conditions are encountered, hydrocarbon fuel may be mixed with the hydrogen rich gases and air and the mixture is then injected into the remaining cylinders as fuel.
Official Gazette of the U.S. Patent Office

N77-31498 Polish Academy of Sciences, Warsaw.
AN EVALUATION OF THE FITNESS OF METHODS OF THE THEORY OF PLASTICITY FOR DESIGNING MACHINE ELEMENTS ON THE BASIS OF FATIGUE TESTING OF KNUCKLE JOINTS [OCENA PRZYDATNOSCI METOD TEORII PLASTYCZNOSCI DO PROJEKTOWANIA ELEMENTOW MASZYN NA PODSTAWIE BADAN ZMECZENIOWYCH POLACZEN SWORZNIOWYCH]
Lech Dietrich 5 Nov. 1976 28 p refs In POLISH
Avail: Issuing Activity

A steel lug with different types of loading is studied. The limit of fatigue endurance for various test pieces similar in form but differing in their characteristic dimension (which in this case is the lug height) is determined. The optimal (in terms of cyclic loading) height dimension is found and a comparison is made with the estimates of the dimension derived by the methods of the theory of plasticity. Author

N77-31499 Polish Academy of Sciences, Warsaw. Inst. of Basic Engineering Problems.
STRENGTH AND OPTIMALIZATION OF THE DESIGN OF MACHINERY AND CONSTRUCTION [WYTRZYMALOSC I OPTYMALIZACJA KONSTRUKCJI MASZNOWYCH I BUDOWLANYCH]
Wojciech Szczepinski 8 Nov. 1976 14 p In POLISH
Avail: Issuing Activity

Advanced methods of calculating, designing, and studying structures for improving the level of designing machinery, equipment, and construction elements, particularly in terms of strength, are outlined. Author

N77-31500*# Rocketdyne, Canoga Park, Calif.
SMALL HIGH-SPEED SELF-ACTING SHAFT SEALS FOR LIQUID ROCKET ENGINES Final Report, Jul. 1973 - Dec. 1976
R. E. Burcham and J. L. Boynton Jul. 1977 215 p refs
(Contract NAS3-17769)
(NASA-CR-135167; RI/RD77-195) Avail: NTIS HC A10/MF A01 CSCL 11A

Design analysis, fabrication, and experimental evaluation were performed on three self-acting facetype LOX seal designs and one circumferential-type helium deal design. The LOX seals featured Rayleigh step lift pad and spiral groove geometry for lift augmentation. Machined metal bellows and piston ring secondary seal designs were tested. The helium purge seal featured floating rings with Rayleigh step lift pads. The Rayleigh step pad piston ring and the spiral groove LOX seals were successfully tested for approximately 10 hours in liquid oxygen. The helium seal was successfully tested for 24 hours. The shrouded

Rayleigh step hydrodynamic lift pad LOX seal is feasible for advanced, small, high-speed oxygen turbopumps. Author

N77-31501*# National Aeronautics and Space Administration. Pasadena Office, Calif.

AN IMPROVED VEHICULAR IMPACT ABSORPTION SYSTEM Patent Application

Albert C. Knoell (JPL) and Abraham N. Wilson, inventors (to NASA) (JPL) Filed 19 Aug. 1977 11 p Sponsored by NASA (Contract NAS7-100)

(NASA-Case-NPO-14014-1; US-Patent-Appl-SN-826204) Avail: NTIS HC A02/MF A02 CSCL 05H

An improved vehicular impact absorption system is reported that uses aligned crash cushions of substantially cubic configurations, each consisting of voided aluminum beverage cans arranged in superimposed tiers and a covering envelope formed of metal hardware cloth. A plurality of cables extends through the cushions in substantial parallelism with an axis of alignment for the cushions to be anchored at each of the opposite ends. NASA

N77-31502*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL EVALUATION OF FOIL-SUPPORTED RESILIENT-PAD GAS-LUBRICATED THRUST BEARING

Zolton N. Nemeth Sep. 1977 20 p refs

(NASA-TP-1030; E-9061) Avail: NTIS HC A02/MF A01 CSCL 13I

A new type of resilient-pad gas thrust bearing was tested to determine the feasibility of the design. The bearing consists of carbon graphite pads mounted asymmetrically on foil beams. Two bearing configurations were tested at thrust loads from 27 to 80 newtons at speeds to 9000 rpm. The outside diameter of the bearing was 8.9 centimeters. Author

N77-31503# Northrop Corp., Des Plaines, Ill. Defense Systems Dept.

LOW RF LOSS METAL-CERAMIC BONDS Final Technical Report, 18 Nov. 1974 - 18 Dec. 1975

Robert E. Russell Nov. 1976 82 p

(Contract F33615-75-C-1096; AF Proj. 2002)

(AD-A039334; Rept-094-007564; AFAL-TR-76-104) Avail: NTIS HC A05/MF A01 CSCL 11/1

This report covers the results of an investigation of a technological process for the production of consistent bonds between metal and ceramic components for use in the RF circuit of high power microwave devices. Sputter metallization of the ceramic components with the incorporation of a thin active titanium metal layer comprises the basic process. Special attention was placed on surface smoothness and contamination of the metallization. No heat barrier at the metal-ceramic interfaces was found. Also, low RF losses were realized. GRA

N77-31504# Pennsylvania State Univ., University Park. Applied Research Lab.

THREE DIMENSIONAL INVISCID EFFECTS AND LIMITATIONS OF CASCADE THEORY IN AXIAL FLOW TURBOMACHINERY M.S. Thesis

A. Tamura 18 Apr. 1974 152 p refs

(Contract N00017-73-C-1418)

(AD-A040672; TM-74-78) Avail: NTIS HC A08/MF A01 CSCL 13/7

The general objective of the investigation reported in this thesis is to obtain a reliable understanding of the three dimensional potential flow through axial flow turbomachinery. The calculation of the three dimensional potential flow through an impeller is based on the method of distributed singularities. The blades are replaced by a series of line vortices and line sources which have their axes along the radial direction and are arranged along the blade camber surface. The basic perturbed velocity fields due to a single radial vortex line of constant strength and a single radial source line of variable strength along the radial direction are computed from a modified theory based on Tyson's and Rossow's formulation. Since the resultant perturbed flow fields are solutions of the linear Laplace equation and the boundary conditions are homogeneous, these solutions may be superimposed for a series of radial vortex lines and source lines located at arbitrary points. Eigen values and related functions are calculated for Bessel function of order m = 0 to 100, number of eigenvalues for each order of Bessel function n - 20, hub-to-tip ratio nu = 0.3, 0.6. A computer program to obtain the three dimensional flow field in a turbomachinery with arbitrary number of blades, number of singular points per blade, and singular points locations was developed. Examples illustrating the interference effects due to hub-to-tip ratio, stagger angle, numbers of the blades were carried out. The effects of the radial variation of the strength of the radial source line were examined. The three dimensional effects are found to be appreciable for low hub tip configuration with fewer number of blades.

Author (GRA)

N77-31505# Oklahoma State Univ., Stillwater. Fluid Power Research Center.

DEVELOPMENT OF A STABILITY MONITOR/CONTROLLER FOR MATERIAL HANDLING EQUIPMENT, PHASE 1 Final Report, 21 Jun. 1976 - 28 Feb. 1977

C. A. Whitehead, B. Burns, and B. Talbot Apr. 1977 62 p refs

(Contract DAAG53-76-C-0144)

(AD-A040842) Avail: NTIS HC A04/MF A01 CSCL 13/3

The purpose of this two-phased study is to investigate the feasibility of developing a stability monitor or controller suitable for material handling equipment (MHE). Recommendations were to be made as to the optimal method (Phase I). This report documents Phase I of the investigation. A mathematical model of a typical vehicle (warehouse lift truck) is derived. This information provides a foundation for proposing two basic approaches. Mathematical and experimental investigations reveal that flaws existed in both of these, and a third approach is proposed which is a combination of the previous two. Two types of controls are recommended - one of which is effectively a monitor-type system. GRA

N77-31506# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.

ON BOUNDS FOR THE TORSIONAL STIFFNESS OF SHAFTS OF VARYING CIRCULAR CROSS SECTION

E. Reissner May 1977 10 p refs

(Contract N00014-75-C-0158)

(AD-A040323) Avail: NTIS HC A02/MF A01 CSCL 20/1

The upper and lower bound formulas for the torsional stiffness of shafts of varying circular cross sections are computed in accordance with the classical Michell formulation of this problem, through use of the principles of minimum potential and complementary energy. The general results are used to obtain explicit first-approximation bounds which, for the limiting case of the cylindrical shaft, reproduce the known elementary exact results. It is conjectured that the first-approximation lower bound is significantly closer to the exact result than the first-approximation upper bound. GRA

N77-31507# Timken Co., Canton, Ohio.

TAPERED ROLLER BEARING DEVELOPMENT FOR AIRCRAFT TURBINE ENGINES Final Report, 8 Mar. 1976 - 8 Mar. 1977

Peter S. Orvos Wright-Patterson AFB, Ohio AFAPL Apr. 1977 92 p refs

(Contract F33615-76-C-2019)

(AD-A041317; AFAPL-TR-77-6) Avail: NTIS HC A05/MF A01 CSCL 21/5

Finite element methods were used to structurally analyze various potential high speed tapered roller bearing cage designs. These cage designs included roller guided and race guided configurations. The two approaches used in the analysis were first to model the full cage using beam elements and then intensively analyze a segment using solid elements. In summary it was determined that centrifugal forces mostly affect high speed cage stress and deformation, and the race guided cage exhibits the greatest strength. Author (GRA)

N77-31508# California Univ., Berkeley. Lawrence Berkeley Lab.

MODELING OF THE ELECTROCHEMICAL MACHINING PROCESS

J. B. Riggs Jan. 1977 50 p refs

(Contract W-7405-eng-48)

(LBL-6019) Avail: NTIS HC A03/MF A01

A computer-implemented model for predicting electrochemical machining (ECM) work piece geometry was developed and then verified by electrochemically sinking holes in copper and stainless steel using a commercial ECM machine. An empirically determined estimate was used by the model in the prediction of eight equilibrium ECM cuts and of six unsteady-state profiles for copper, which gave satisfactory correspondence with experiment. A similar approach was used for model prediction for stainless steel. A method of correlating characteristics of equilibrium ECM cuts with the operating variables was also presented. This method can be used to predict the operating conditions which yield the desired cut dimensions. ERA

N77-31509# Sandia Labs., Albuquerque, N. Mex.
STUDY OF THE MECHANICS OF TAPE INSERTION AND RESULTING ASSEMBLY FORCES IN AN INTERLOCKING TAPE JOINT
Richard E. Blose Jan. 1977 34 p refs
(Contract EY-76-C-04-0789)
(SAND-75-0409) Avail: NTIS HC A03/MF A01

A series of tests were completed studying the mechanical loading effects in the assembly of a tape joint. Topics considered include: the effects of plating and lubricant on joint loading, the effects of plating and lubricant on friction, and uniformity of joint loading. A unique method for consistently driving the tapes into the joint to obtain a desired region of joint loading was developed. ERA

N77-31510# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Development Dept.
SURFACE-FINISH MEASUREMENT WITH INTERFERENCE MICROSCOPES
R. E. Sladky Feb. 1977 65 p refs Sponsored in part by AF
(Contract W-7405-eng-26)
(Y-2060) Avail: NTIS HC A04/MF A01

Diamond turning copper and other metals, to produce mirror surfaces with reflectivities generally higher than can be obtained by lapping and polishing, has become an important new technology. Evaluation of the finish of these surfaces requires careful examination, using optical instruments. Background information about the theory is provided. Data from several specimens were acquired that show the type of surface finish that is obtained. Mirrors were fabricated that show the state of the art that was achieved in diamond turning copper and nickel. ERA

N77-31511# Bendix Corp., Kansas City, Mo.
CERAMIC-TO-METAL SEALING Final Report
W. G. Gates Mar. 1977 22 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1683-Rev; PDO-6989258) Avail: NTIS HC A02/MF A01

Ceramic-to-metal sealing was accomplished by brazing a metallized alumina insulator to a Kovar (Carpenter Technology Corporation) pin and header. A braze alloy wetting evaluation and a braze joint tensile strength evaluation were completed by brazing the specimens in a hydrogen atmosphere. From these evaluations the best braze alloy and brazing cycle were selected. Twelve braze alloys were evaluated and Nicusil 3 (Western Gold and Platinum Company) braze alloy was found to have good wetting characteristics and optimum strength. Assemblies brazed with this alloy were vacuum leak tight and metallurgically sound. ERA

N77-31512# Calspan Corp., Buffalo, N. Y.
HIGHWAY-VEHICLE-OBJECT SIMULATION MODEL-1976. VOLUME 1: USERS MANUAL Final Report, Feb. 1974 - Feb. 1976
David J. Segal Feb. 1976 429 p refs 4 Vol.
(Contract DOT-FH-11-8265)
(PB-267401/8; CALSPAN-ZR-5461-V-6-Vol-1;
FHWA-RD-76-162-Vol-1) Avail: NTIS HC A19/MF A01; HC also available in set of 4 reports PC E16, PB-267400-SET CSCL 13F

This manual provides an introduction to the simulation and enough information for a user to submit a run, obtain results, and interpret the HVOSM output. GRA

N77-31513# Calspan Corp., Buffalo, N. Y.
HIGHWAY-VEHICLE-OBJECT SIMULATION MODEL-1976. VOLUME 2: PROGRAMMERS MANUAL Final Report, Feb. 1974 - Feb. 1976
David J. Segal Feb. 1976 581 p refs 4 Vol.
(Contract DOT-FH-11-8265)
(PB-267402/6; CALSPAN-ZR-5461-V-7-Vol-2;
FHWA-RD-76-163-Vol-2) Avail: NTIS HC A25/MF A01; HC also available in set of 4 reports PC E16, PB-267400-SET CSCL 13F

Detailed descriptions of the subroutines and linkages among them designed to be used in conjunction with a source program listing are outlined. Ancillary information of interest to the programmer is also included. GRA

N77-31514# Calspan Corp., Buffalo, N. Y.
HIGHWAY-VEHICLE-OBJECT SIMULATION MODEL-1976. VOLUME 3: ENGINEERING MANUAL-ANALYSIS Final Report, Feb. 1974 - Feb. 1976
David J. Segal Dec. 1975 192 p refs 4 Vol.
(Contract DOT-FH-11-8265)
(PB-267403/4; CALSPAN-ZR-5461-V-8-Vol-3;
FHWA-RD-76-164-Vol-3) Avail: NTIS HC A09/MF A01; HC also available in set of 4 reports PC E16, PB-267400-SET CSCL 13F

The mathematical model which is the basis for the HVOSM computer simulation is described. A detailed description of the governing equations and logic for the three documented versions of the HVOSM are given. GRA

N77-31515# Calspan Corp., Buffalo, N. Y.
HIGHWAY-VEHICLE-OBJECT SIMULATION MODEL-1976. VOLUME 4: ENGINEERING MANUAL VALIDATION Final Report, Feb. 1974 - Feb. 1976
David J. Segal Feb. 1976 236 p refs 4 Vol.
(Contract DOT-FH-11-8265)
(PB-267404/2; CALSPAN-ZR-5461-V-4-R-Vol-4;
FHWA-RD-76-165-Vol-4) Avail: NTIS HC A11/MF A01; HC also available in set of 4 reports PC E/16, PB-267400-SET CSCL 13F

Evidence of the validity of the HVOSM mathematical model and computer simulation is discussed. Both rigorous tests of validity by comparisons with extensively documented full-scale tests and general comparisons are included. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-31516# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
ULTRASONIC DETECTION OF FATIGUE DAMAGE IN AIRCRAFT COMPONENTS Annual Report, 1 Mar. - 28 Feb. 1977
Robert E. Green, Jr. and Robert B. Pond, Sr. Mar. 1977 114 p refs
(Contract F44620-76-C-0081)
(AD-A040009; AFOSR-77-0658TR) Avail: NTIS HC A06/MF A01 CSCL 11/6

The purpose of the present research is to extend and apply the ultrasonic techniques developed under AFOSR Contract No. F44620-71-C-0062 to the detection of fatigue damage in test specimens which are made from materials and possess geometries typical of actual aircraft components. Ultrasonic attenuation measurements made simultaneously with fatigue tests on aluminum alloy bars gave warning of crack formation and eminent fracture much earlier than conventional ultrasonic methods. Similar tests are currently being run on aluminum alloys possessing geometries typical of actual aircraft components. Analysis of acoustic emission measurements made simultaneously with ultrasonic attenuation measurements during fatigue testing have run into difficulty because of the lack of a proper acoustic emission characterization system which would permit optimum separation

of the defect created acoustic emission signals from the background noise. GRA

N77-31517# George Washington Univ., Washington, D.C. Program in Logistics.
FAILURE RATE ESTIMATION USING RANDOM SMOOTHING
Douglas R. Miller and Nozer D. Singpurwalla 4 Apr. 1977 31 p refs Sponsored in part by Nucl. Regulatory Comm.
(Contracts N00014-75-C-0729; N00014-76-C-0843)
(AD-A040999; Serial-T-347) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this note, some aspects of the distribution theory of an estimator of the failure-rate function are investigated. A slightly different approach to some asymptotic results of Singpurwalla for the failure rate process from exponential lifetime are given and clarified. In addition, these results are extended to the case of general lifetimes. This leads to confidence regions for 'randomly smoothed' versions of the failure-rate function, for both finite and large samples. GRA

N77-31518# George Washington Univ., Washington, D.C. Program in Logistics.
A STATISTICAL ANALYSIS OF SOME MODELS USED IN ACCELERATED LIFE TESTS Ph.D. Thesis
Henry D. Kahn 8 May 1977 76 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A041001; Serial-T-353) Avail: NTIS HC A05/MF A01 CSCL 12/1

This paper considers the problem of inference for the parameters of three models used in accelerated life tests. The first part obtains orthogonal least squares estimators for the parameters of the models. The second part considers a Bayesian analysis of the two parameters of the power rule model. The absolutely continuous bivariate exponential (ACBVE) distribution is assigned as a joint prior on the power rule parameters. The analysis proceeds along the lines dictated by Box and Tiao in their book, Bayesian Inference in Statistical Analysis. Thus, location parameters are introduced in the ACBVE so that the prior is shifted to a position where the likelihood is appreciable. For computational convenience, the joint prior is discretized over regions of the parameter space where the likelihood is appreciable. This approach allows some generality in the choice of joint priors. Using the approach, conclusions are reached pertaining to the robustness of the inferences with respect to assumptions about the Weibull shape parameter. Author (GRA)

N77-31519# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
COMPARISON OF STRESS MEASUREMENTS BY X-RAYS WITH THREE DIFFERENT DETECTORS AND A STRONGLY FLUORESCING SPECIMEN
M. R. James and J. B. Cohen 20 May 1977 21 p refs
(Contract N00014-75-C-0580; NR Proj. 031-733)
(AD-A040613; TR-17) Avail: NTIS HC A02/MF A01 CSCL 20/11

Measurements on the heat affected zone of a weldment are presented using the position sensitive detector and a normal diffractometer equipped with a scintillation detector and a solid state detector. The sample, a surface ground titanium alloy, provided a classic applications problem for the X-ray technique from which a real analysis of the position sensitive detector could be made. The diffraction profile from the Ti alloy is very broad and the fluorescence produces a high background. The fluorescence is easily rejected using a solid state detector, however, the time of analysis is very long. With the position sensitive detector, the combination of increased energy discrimination over the scintillation detector and the simultaneous measurement of many data points over the broad peak enabled the measurements to be made for the same accuracy in much shorter times than for either the solid state detector or the scintillation detector. Author (GRA)

N77-31520# Missouri Univ., Columbia. Dept. of Statistics.
FAILURE RATE ESTIMATION USING RANDOM SMOOTHING Interim Technical Report
Douglas R. Miller and Nozer D. Singpurwalla (George Washington Univ. Wash., D. C.) Apr. 1977 29 p refs
(Contract N00014-76-C-0843; AT(49-24)-0211; N00014-75-C-0729; NR Proj. 347-020)
(AD-A041028; TR-67) Avail: NTIS HC A03/MF A01 CSCL 14/4

This note investigates some aspects of the distribution theory of an estimator of the failure-rate function. It clarifies and gives a slightly different approach to some asymptotic results of Singpurwalla for the failure rate process from exponential lifetimes. In addition, we extend these results to the case of general lifetimes. This leads us to confidence regions for randomly smoothed versions of the failure-rate function, for both finite and large samples. GRA

N77-31521# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
A SURVEY OF NETWORK APPROACHES TO COMPLEX SYSTEM RELIABILITY Final Technical Report
P. Nanda and K. Okumotu Griffiss AFB, N. Y. RADC Jan. 1977 33 p refs
(Contract F30602-71-C-0312; AF Proj. 4540)
(AD-A036683; RADC-TR-77-12) Avail: NTIS HC A03/MF A01 CSCL 14/4

The determination of complex systems reliability has become a subject of great concern to reliability engineers. As systems become increasingly complex, determination of system reliability becomes increasingly difficult. The purpose of this report is to survey some of the most recent developments in this area with a view to expose reliability engineers to these techniques. An algorithm that seems to be the most efficient to date is delineated. The concepts surveyed are then extended to calculation of time dependant complex systems reliability and the availability of repairable systems. GRA

N77-31522# Southwest Research Inst., San Antonio, Tex.
NONDESTRUCTIVE TESTING INFORMATION ANALYSIS CENTER, 1976 Annual Technical Report, 15 Feb. 1976 - 15 Feb. 1977
W. W. Bradshaw, F. P. Hicks, R. R. King, and R. T. Smith Jun. 1977 32 p
(AD-A041262; SWRI-15-3903(3)) Avail: NTIS HC A03/MF A01 CSCL 05/2

During the contract year, a total of approximately 12,000 entries have been reached in NTIAC's computerized data file records. The NTIAC Newsletter has a distribution of approximately 3,000 recipients. A State-of-the-Art Survey on Advanced Ultrasonic Testing Systems was published. NTIAC responded to over 100 technical inquiries. Author (GRA)

N77-31523# Naval Air Development Center, Warminster, Pa. Vehicle Technology Dept.
FATIGUE EVALUATION OF AUTO-TIG WELD COUNTS FOR HEAT EXCHANGER APPLICATIONS Final Report
J. J. Bethke 31 Jan. 1977 32 p
(AD-A041679; NADC-76316-30) Avail: NTIS HC A03/MF A01 CSCL 13/5

Fatigue tests were performed to compare the dynamic load response of auto-TIG step pulse welds with currently used manual electric arc welds in heat exchanger joint applications. The new auto-TIG weld technique for fabricating the joints, designed by the Naval Ship Engineering Center, Philadelphia Division has been shown to be more time and cost effective. Full-scale joints were used to test specimens representing the heat exchanger cooling tube to end wall assembly and consisted of a 2.25 Cr - 1.0 Mo heat resistant steel tube of 3.18 cm (1.25 in.) outside diameter welded to a 1.25 Cr - 1.0 Mo end wall section containing an oversized 3.18 cm (1.25 in.) diameter hole. GRA

N77-31524# Argonne National Lab., Ill.
MICROSTRUCTURAL EFFECTS AND SIGNAL-ENHANCEMENT TECHNIQUES IN ULTRASONIC EXAMINATION OF STAINLESS STEEL
D. S. Kupperman Sep. 1976 26 p refs
(Contract W-31-109-eng-38)
(ANL-76-115) Avail: NTIS HC A03/MF A01

The effects of stainless steel microstructure on ultrasonic test results are described, and several signal-processing techniques for enhancing ultrasonic flaw signals are discussed. Welded coupons, 25 and 50 mm thick, were fabricated from Type 304

stainless steel, with 308 stainless steel as the weld metal. Metallography showed grain sizes of 15 and 80 microns in the base material and dendrites aligned from the top to the bottom surface in case samples. X-ray diffraction and ultrasonic velocity measurements indicated a random crystal orientation in the base metal, and the cast sample had aligned dendrites. The weld metal exhibited a dendritic structure with a preferred (100) direction perpendicular to the weld pass. Spectral analysis of ultrasonic broadband signals through the base metals showed drastic attenuation of higher frequencies with increasing grain size. ERA

N77-31525# Babcock and Wilcox Co., Alliance, Ohio.
INVESTIGATION OF MECHANICAL PROPERTIES AND CHEMISTRY WITHIN A THICK MnMoNi SUBMERGED ARC WELDMENT
W. A. VanDerSluys, R. R. Seeley, and J. E. Schwabe Feb. 1977 223 p refs Prepared in cooperation with Babcock and Wilcox Co., Lynchburg, Va.
(EPRI Proj. 232-3-0)
(EPRI-NP-373) Avail: NTIS HC A10/MF A01

The mechanical properties-tensile, impact, drop weight NDT and static and dynamic fracture toughness-were determined at five locations through the thickness of the weldment-outside surface (of the vessel), 1/4 T,1/2 T,3/4 T, and inside surface. The tensile properties through the thickness vary to a minor degree and are similar for the two wireflux combinations. The best impact properties occur at 1/2 T, 3/4 T,3/4 T,and inside surface positions involving one wire-flux combinations. The static and dynamic fracture toughness properties at RT/sub NDT/ + 60 F do not vary appreciably throughout the weldment thickness. The toughness properties seem to be insensitive to acceptable variations in weld-wire chemistry. A very comprehensive survey of the chemical analysis of the weldment was made using spectrographic and electron microprobe analysis techniques. The results of this survey indicate the weld metal has lower concentrations of C, CR, Mo, Sn, V, Ni, and higher concentrations of Mn, P, S, Si, and Cu than the base metal. The analysis results of the electron microprobe technique generally agree with those of the spectrographic technique. ERA

N77-31526# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
A TEST UNIT FOR EVALUATING THE MECHANICAL ENDURANCE OF SLIDE FASTENERS ZIPPERS Final Report
Vasant K. Devarakonda May 1977 28 p
(AD-A040228; CE/MEL-178) Avail: NTIS HC A03/MF A01 CSCL 13/5

There is a need for a reliable and reproducible means of evaluating the performance and durability of slide fasteners (zippers). No standard test procedures nor equipments are presently available. This project was undertaken to develop a slide fastener tester with operational and constructional features which would be adaptable to evaluate different sizes and types of slide fasteners under conditions simulating actual usage. These evaluations would form the basis for (1) establishing a systematic procedure of applying the proper type slide fastener in the design and manufacture of different Army items and (2) determining the acceptability of slide fasteners in DoD procurement quality assurance operations. The work on this project resulted in the development of a prototype slide fastener tester. Its design was predicated on the operational features and controls engineered in the initial laboratory model. Author (GRA)

N77-31527# Battelle Columbus Labs., Ohio.
MULTIFREQUENCY EDDY CURRENT INSPECTION FOR CRACKS UNDER FASTENERS Final Report, Dec. 1975 - Oct. 1976
J. H. Flora, H. T. Gruber, R. E. Thomas, and R. P. Meister 15 Dec. 1976 135 p
(Contract F33615-76-C-5062)
(AD-A040591; AFML-TR-76-209) Avail: NTIS HC A07/MF A01 CSCL 01/3

The experimental evaluation was conducted on two typical wing splice joint configurations used in the C5-A aircraft consisting of two aluminum layers each 3/16 to 1/4 inches thick. Notches simulating cracks were machined in a radial direction extending from the fastener hole and the faying surface between sheets. A digital eddy-current system designed around a PDP-11/40 minicomputer was utilized for the experimental evaluations. The digital system was programmed to generate the signal wave-forms that excite the test coil and perform the function of phase-sensitive detection of response signals that are received from the test coil. Special test coils were designed to induce eddy currents in the aluminum alloy that lies beneath the head of the fasteners. A series of measurements were taken on the wing-splice samples at various frequencies, excitation levels, and phase settings. These data were analyzed using the Automatic Interaction Detector, AID, computer code to indicate initial capabilities of crack detection, and to compare the various operating parameters such as excitation frequency and test coil design. GRA

N77-31528# Missouri Univ., Columbia. Dept. of Statistics.
A CONTINUITY THEOREM AND SOME COUNTEREXAMPLES FOR THE THEORY OF MAINTAINED SYSTEMS
Douglas R. Miller Nov. 1976 15 p refs
(Contract N00014-76-C-0843)
(AD-A041027) Avail: NTIS HC A02/MF A01 CSCL 14/4

The reliability of maintained systems is considered. A continuity theorem is presented which states that the stochastic behavior of a maintained system depends continuously on the stochastic behavior of its components. Examples of maintained systems with IFR component lifetimes and exponential repair times are presented for which time until first system failure is not NBU. Author (GRA)

N77-31529# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ADVANCED HIGH SPEED ROLLER BEARING INSPECTION TECHNIQUES Final Report, 30 Oct. 1976 - 1 Apr. 1977
Jerold L. Jacoby and Jack R. Bohn May 1977 80 p refs
(Contract F33615-76-C-2147)
(AD-A042121; AFAPL-TR-77-32) Avail: NTIS HC A05/MF A01 CSCL 14/2

A comprehensive survey of state-of-the-art precision measurement techniques applicable to dimensional inspection of rollers for high speed bearings (greater than 2.0 million DN) was undertaken. Particular attention was given to noncontacting techniques which would permit automated 100% inspection of the rollers for use in such bearings. The measurement techniques were evaluated to determine their utility for incorporation into a cost-effective roller inspection system. A concept for a fully automated roller inspection system is described. It provides for the preparation, inspection, re-oiling and sorting of the rollers with minimal human supervision. The system is conceived to be self-contained so that it can operate independent of environmental constraints. It can be developed by adapting existing technology to the specific requirements for roller inspection. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-31530 Pennsylvania Univ., Philadelphia.
CRACK NUCLEATION AND STAGE 1 PROPAGATION IN HIGH STRAIN FATIGUE Ph.D. Thesis
Woo Hyung Kim 1976 202 p
Avail: Univ. Microfilms Order No. 77-10178

The phenomena of fatigue crack nucleation and of the cyclic deformation effects which give rise to cracks have been studied by detailed microscopic and interferometric observations coupled with replication techniques. Crack nucleation has been found to occur by the development of a step at a perferred grain boundary. The nature of the boundaries causing the steps and associated cracks has been determined. A significant increase in the number of cycles to crack initiation with decreasing grain size has been observed and explained by the existence of a critical step height for crack nucleation. Models for crack nucleation and stage

propagation in high strain fatigue have been proposed. The plastic blunting process is the governing mechanism in both stage one and stage two crack propagation in high strain fatigue.
Dissert. Abstr.

N77-31531 Polish Academy of Sciences, Warsaw.
DETERMINING THE AMPLITUDES OF RESONANCE VIBRATIONS OF A T-SHAPED FRAME TAKING INTO CONSIDERATION CONSTRAINT EQUATIONS [WYZNACZANIE AMPLITUD DRGAN REZONANSOWYCH RAMY W KSZTALCIE LITERY T PRZY UWZGLEDNIENIU ROWNAN WIEZOW]
Stefan Kotowski and Andrzej Olas 25 Nov. 1976 24 p In POLISH
Avail: Issuing Activity

The frequency of free vibrations of a T-shaped frame node and the amplitudes of resonance vibrations of the frame at selected points are determined. A method of rigid finite elements of complementation which is reduced to an algorithm by admission of constraint equations is presented. Author

N77-31532 Polish Academy of Sciences, Warsaw.
AN ULTRASONIC METHOD OF STUDYING THE SETTING CHARACTERISTICS OF CEMENTS [ULTRADZWIEKOWA METODA BADANIA WLASNOSCI WIAZACYCH CEMENTOW]
Ewa Drescher 15 Oct. 1976 29 p refs In POLISH
Avail: Issuing Activity

Velocity and attenuation changes of longitudinal ultrasonic waves were studied concerning the frequency function and the setting time of a paste. Results of the cement hydration process were correlated. A strong dispersion of velocity and the characteristic maximum of attenuation of ultrasonic waves occurring in the first stages of the cement hydration process were revealed. The length of ultrasonic waves corresponding to the attenuation maximum after a given hydration period was calculated using a velocity dispersion curve. Author

N77-31533 Polish Academy of Sciences, Warsaw.
ANALYSIS OF ADAPTATION OF AN ELASTIC-VISCOUS-PLASTIC ROD [ANALIZA PRZYSTOSOWANIA PRETA SPREZYSTO-LEPKO-PLASTYCZNEGO]
Jagoda Madej 8 Dec. 1976 29 p refs In POLISH
Avail: Issuing Activity

The theory of adaptation has been extended to various instances of thermic load in the matter of safety of construction elements subjected to raised temperatures. At higher temperatures (usually in the range of 400 to 600 C) metals which at room temperature deform only in an elastic or plastic manner begin to exhibit viscous qualities, manifested as creep or stress reduction. The presence of viscous deformations which evoke certain effects and the quantitative differences with respect to the results of classic elastic-plastic analysis are demonstrated. Author

N77-31534 Polish Academy of Sciences, Warsaw.
MECHANICAL PROPERTIES OF A PLASTICALLY DEFORMED MATERIAL DURING COMPLEX MULTIPLE LOADING [WLASNOSCI MECHANICZNE MATERIALU ODKSZTALCONEGO PLASTYCZNIE PRZY ZLOZONYCH WIELOKROTNYCH OBCIAZENIACH]
Jozef Miastkowski 8 Dec. 1976 116 p refs In POLISH
Avail: Issuing Activity

The method of loading and the measuring technique used to determine the mechanical properties of a plastically deformed material during complex multiple loading are presented. A theoretical analysis of this phenomenon was carried out based on the hypothesis of kinematic strengthening. Large flat test pieces of an aluminum alloy were subjected to preliminary cyclic loading in two mutually perpendicular directions along the x and y axis. Three different load values were used. Flow surfaces obtained after preliminary cyclic loadings were compared with varying number of semi-cycles. Along with an increase in the number of loading cycles, the surfaces obtained for neighboring stages of loading assumed common characteristics. Author

N77-31535 Polish Academy of Sciences, Warsaw.
FATIGUE TESTING OF A STRIP WITH HOLES [BADANIA ZMECZENIOWE PASMA Z OTWORAMI]
Lech Dietrich 8 Dec. 1976 39 p refs In POLISH
Avail: Issuing Activity

From static studies during the stretching of a strip of the aluminum alloy PA2 weakened with five holes, the optimal spacing between rows of holes was determined, preserving the invariables of the other dimensions of the element. This optimal value is close to the theoretical estimate based on the statically admissible stress field. From fatigue tests conducted with cyclic loading of the test pieces in which the zero value of minimal loading was maintained for constant average stresses in the cycle, the very same optimal values of spacing between rows of holes which conform with the theoretical upper estimate of that dimension were determined. The tests confirmed the conclusion reached from an analysis of the stress concentration in dependence on the S dimension that this element, which was designed on the basis of the statically permissible stress field, is likewise optimal with regard to longlasting cyclic loading. Author

N77-31536 Polish Academy of Sciences, Warsaw.
MECHANICAL PROPERTIES OF MATERIALS UNDERGOING STRETCH AND COMPRESSION [MECHANICZNE WLASNOSCI MATERIALOW PRZY ROZCIAGANIU I SCISKANIU]
Jozef Miastkowski 22 Nov. 1976 104 p refs In POLISH
Avail: Issuing Activity

Mechanical properties of metals are determined by stretching and compression tests taking into account the influence of internal factors on certain mechanical properties. Stretching of plastic and brittle materials, elastic and plastic deformation, the effects of temperature, speed of loading, alloy addition, thermal processing, irradiation, and time are discussed. Material compression is studied in depth. Experiments performed are described in detail and the Bauschinger effect is analyzed. Author

N77-31537*# Old Dominion Univ. Research Foundation, Norfolk, Va.
VIBRATION ANALYSIS OF ROTOR BLADES WITH AN ATTACHED CONCENTRATED MASS Technical Report, 1 Jun. - 15 Aug. 1976
V. R. Murthy and P. S. Barna Aug. 1977 191 p refs
(Grant NsG-1143)
(NASA-CR-154987) Avail: NTIS HC A09/MF A01 CSCL 20K

The effect of an attached concentrated mass on the dynamics of helicopter rotor blades is determined. The point transmission matrix method was used to define, through three completely automated computer programs, the natural vibrational characteristics (natural frequencies and mode shapes) of rotor blades. The problems of coupled flapwise bending, chordwise bending, and torsional vibration of a twisted nonuniform blade and its special subcase pure torsional vibration are discussed. The orthogonality relations that exist between the natural modes of rotor blades with an attached concentrated mass are derived. The effect of pitch, rotation, and point mass parameters on the collective, cyclic, scissor, and pure torsional modes of a seesaw rotor blade is determined. Author

N77-31538*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF THE VIBRATION CHARACTERISTICS OF A MODEL OF AN ASYMMETRIC MULTIELEMENT SPACE SHUTTLE
Ulysse J. Blanchard Sep. 1977 114 p refs
(NASA-TN-D-8448; L-11211) Avail: NTIS HC A06/MF A01 CSCL 13M

Vibration investigations of a model of the asymmetric multielement space shuttle were made. The influence on overall motions of local deformation in the vicinity of element interfaces, high modal density, low structural damping, and high responsiveness in the crew cabin are included in the findings. Mode frequencies generally increase with decreasing propellant masses and staging of elements. Author

N77-31539# University of Mining and Metallurgy, Leoren (Austria).
PREDICTION OF FATIGUE CRACK PROPAGATION UNDER SERVICE-LIKE LOAD SEQUENCES
1977 22 p refs In GERMAN; ENGLISH summary Presented

at the Intern. Werkstoffprueftagung, Leoben, Austria, 25-26 Nov. 1976
(ICAF-950) Avail: NTIS HC A02/MF A01

The complex phenomena occuring in the material in the vicinity of the crack tip after high stress peaks are enumerated. Three pragmatic prediction methods are compared with experimental results. The Wheeler model is the most suitable method attained through high experimental effort. Many of these models are described and critically examined in an appendix. Author

N77-31540# Technische Universitaet, Munich (West Germany).
A PROCEDURE FOR CALCULATING NOTCH- AND GEOMETRICAL-EFFECT AT VIBRATORY LOADS Ph.D. Thesis [EIN VERFAHREN ZUR BERECHNUNG DES KERB- UND GROESSENEINFLUSSES BEI SCHWINGBEANSPRUNCHUNG]
Wolfgang Ziebart 11 Oct. 1976 125 p refs In GERMAN; ENGLISH summary
(ICAF-944) Avail: NTIS HC A06/MF A01

The effects of geometrical shape and size on the fatigue mechanism are explained as follows: (1) in the component are defects of defined size, which are distributed at random; (2)the largest defect propagates under time-varying loading and leads to a fatigue; and (3) propagation takes place only, if the size of the defect is larger than a minimum value. The mathematical model for first two assumptions leads to a calculation method, with which the life of a component in the finite life ranges predicted in dependence from its geometrical shape and size. With the third assumption the region of the endurance limit is covered. The validity of the method is demonstrated. Author

N77-31541# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
STRENGTH EVALUATION OF STEEL STRUCTURES FOR LOW CYCLE FATIGUE [FESTIGKEITSBEURTEILUNG VON BAUTEILEN AUS STAHL IM BEREICH DER KURZZEITSCHWINGFESTIGKEIT]
V. Grubisic and C. M. Sonsino Jan. 1977 50 p refs In GERMAN; ENGLISH summary
(TB-134(1977); ICAF-945) Avail: NTIS HC A03/MF A01

Different structural components as high-pressure vessels for isostatic pressure technology, reactor vessels, containers and pipings used in chemical industry etc. have to be designed for a certain, relatively low number of cycles. For a fail-safe and an optimum design of such structures it is necessary to know the local stress/strain states and the behavior of the material under elastic-plastic cyclic deformations. In this report the basic aspects of elastic-plastic materials behavior under cyclic loading at room temperature are discussed and on the example of high-pressure vessels about the application of low-cycle fatigue and fracture mechanics data as decisive material properties referred. Further, parameters influencing the fatigue behavior of structural components are discussed and the procedure for the service life prediction is described. Author

N77-31542*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF BOW-TYPE INITIAL IMPERFECTION ON THE BUCKLING LOAD AND MASS OF GRAPHITE-EPOXY BLADE-STIFFENED PANELS
W. Jefferson Stroud, Melvin S. Anderson, and Katherine W. Hennessy Aug. 1977 25 p refs
(NASA-TM-74063) Avail: NTIS HC A02/MF A01 CSCL 13M

A structural synthesis computer code which accounts for first order effects of an initial bow and which can be used for sizing stiffened composite panels having an arbitrary cross section is used to study graphite blade-stiffened panels. The effect of a small initial bow on both the load carrying ability of panels and on the mass of panels designed to carry a specified load is examined. Large reductions in the buckling load caused by a small initial bow emphasize the need for considering a bow when a panel is designed. Author

N77-31543*# Illinois Univ., Urbana-Champaign.
VIBROACOUSTIC RESPONSE OF STRUCTURES AND PERTURBATION REYNOLDS STRESS NEAR STRUCTURE-TURBULENCE INTERFACE Final Report
S. Maekawa and Y. K. Lin Washington NASA Sep. 1977 116 p refs
(Grant NsG-1264)
(NASA-CR-2876) Avail: NTIS HC A06/MF A01 CSCL 20K

The interaction between a turbulent flow and certain types of structures which respond to its excitation is investigated. One-dimensional models were used to develop the basic ideas applied to a second model resembling the fuselage construction of an aircraft. In the two-dimensional case a simple membrane, with a small random variation in the membrane tension, was used. A decaying turbulence was constructed by superposing infinitely many components, each of which is convected as a frozen pattern at a different velocity. Structure-turbulence interaction results are presented in terms of the spectral densities of the structural response and the perturbation Reynolds stress in the fluid at the vicinity of the interface. Author

N77-31544*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE USE OF PARABOLIC VARIATIONS AND THE DIRECT DETERMINATION OF STRESS INTENSITY FACTORS USING THE BIE METHOD
Alexander Mendelson 1977 16 p refs Presented at the Symp. on Appl. of Computer Methods Eng., Los Angeles, 23-26 Aug. 1977; sponsored by the Univ. of Southern Calif.
(NASA-TM-X-73681; E-9214) Avail: NTIS HC A02/MF A01 CSCL 13M

Two advances in the numerical techniques of utilizing the BIE method are presented. The boundary unknowns are represented by parabolas over each interval which are integrated in closed form. These integrals are listed for easy use. For problems involving crack tip singularities, these singularities are included in the boundary integrals so that the stress intensity factor becomes just one more unknown in the set of boundary unknowns thus avoiding the uncertainties of plotting and extrapolating techniques. The method is applied to the problems of a notched beam in tension and bending, with excellent results. Author

N77-31545# Army Materials and Mechanics Research Center, Watertown, Mass. Mechanics of Materials Div.
ON STRESS CONCENTRATION FACTOR AND DEFINITIONS OF A CRACK AND STRESS INTENSITY FACTOR Final Report
Reinier Beeuwkes, Jr. Feb. 1977 30 p refs
(DA Proj. 1T1-61102-AH-42)
(AD-A040679; AMMRC-MS-77-3) Avail: NTIS HC A03/MF A01 CSCL 20/11

The common assumption that the stress is infinite at the tip of an in-plane crack is inconsistent with the basic historical solutions for stress for cases from which crack formulae have been evolved. The latter formulae do not satisfy boundary conditions. An appropriate definition of a crack, as does one presented here, should make it obvious that such conditions are to be fulfilled and when they are, the meaning of stress intensity factor as the coefficient of a 1/(square root of r) singularity is altered. It no longer represents an infinity of stress and its connection with actual failure stress through a stress concentration factor leads to a fixed, rather than experimental, connection between Modes I and II stress intensity factors. Furthur discussion of appropriate representations of cracks for shear and normal stress loading is warranted, as well as of toughness definition consistent with failure mechanisms and with elastic-plastic solutions for stress. Author (GRA)

N77-31546# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
A NOTE ON GENERATING GENERALIZED TWO-DIMENSIONAL PLATE AND SHELL THEORIES Interim Report
E. Reissner Apr. 1977 19 p refs
(Contract N00014-75-C-0158)
(AD-A040364) Avail: NTIS HC A02/MF A01 CSCL 20/11

Ordinary two dimensional linear shell theory may be formulated using six differential equations for stress resultants and couples and for middle surface force and moment load intensities, in conjunction with the principle of virtual work for the derivation of strain displacement relations. The present paper deals with a more general formulation, involving additional

two-dimensional equilibrium equations, as a consequence of three-dimensional equations for force and moment stresses in conjunction with a stipulation of surface force and moment load intensities for two face surfaces. Author (GRA)

N77-31547# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
EFFECT OF STRESS-FREE EDGES IN PLANE SHEAR OF A RECTANGULAR ORTHOTROPIC REGION Interim Report
S. Nair Apr. 1977 26 p refs
(Contract N00014-75-C-0158)
(AD-A040425) Avail: NTIS HC A03/MF A01 CSCL 20/11

The plane elastic problem of a rectangular orthotropic region is considered; subject to the boundary conditions of prescribed equal and opposite tangential displacements and zero normal displacements on the upper and lower edges and zero stresses on the remaining edges. The effect of the stress-free edges on the stiffness coefficient relating the tangential displacement and the corresponding shearing force is estimated in the form of upper and lower bounds for this coefficient. Author (GRA)

N77-31548# Watervliet Arsenal, N.Y. Benet Weapons Lab.
THE EFFECT OF AUTOFRETTAGE ON FATIGUE CRACK PROPAGATION IN EXTERNALLY FLAWED THICK-WALLED DISCS
J. A. Kapp May 1977 51 p refs
(AD-A040229; ARLCB-TR-77025) Avail: NTIS HC A04/MF A01 CSCL 20/11

The effect of the autofrettage residual stress distribution on the crack growth rate in externally flawed thick-walled disks has been investigated. The crack growth rate was modeled by using the Paris power law relation. Stress intensity factors were calculated for, internally pressurized, externally flawed, non-autofrettaged cylinders, by an approximate technique and with the use of the NASTRAN finite element computer program. A simple experiment was devised to determine the effect of autofrettage on crack growth rate. The test involved diametrically loading thin disks, cut from autofrettaged cylinders; NASTRAN was used to determine the stress intensity factors for this loading geometry. The experimentally observed results show that autofrettage increases the crack growth rate in externally flawed cylinders, but the test did not supply sufficient data to mathematically model the increase. The faster crack growth rate is believed to be caused by the local relaxation of the tensile autofrettage residual stresses due to large plastic zones accompanying crack growth. Author (GRA)

N77-31549# Washington Univ., Seattle. Dept. of Mechanical Engineering.
A PROCEDURE FOR EVALUATING FRACTURE DYNAMIC PARAMETERS FROM CRACK VELOCITY MEASUREMENTS
A. S. Kobayashi and S. Mall May 1977 18 p refs
(Contract N00014-67-C-0060)
(AD-A041445; TR-28) Avail: NTIS HC A02/MF A01 CSCL 20/11

A combined numerical and experimental procedure for evaluating some of the fracture dynamic parameters which govern the crack run-arrest response in a fracturing plate are discussed. A dynamic finite element code is used to compute the dynamic stress intensity factor and dynamic energy release rate associated with a propagating crack which is driven by the experimentally determined crack velocity. Numerical results generated by the developed procedure are then compared with dynamic stress intensity factors obtained through dynamic photoelastic analyses of fracturing Homalite-100 plates. Two edge-cracked specimens with fixed edge displacement loadings and two wedge-loaded double cantilever beam specimens were considered in this comparative study. Good agreements were obtained between the results obtained by the developed numerical-experimental procedure and dynamic photoelasticity. Author (GRA)

N77-31550# Oak Ridge National Lab., Tenn.
EVALUATION OF SUSTAINED LOAD EFFECTS IN REACTOR PRESSURE VESSELS BY MEANS OF INTERMEDIATE-SCALE FLAWED VESSEL TESTS
R. H. Bryan 1976 27 p Presented at 4th Water Reactor Safety Res. Inform. Meeting, Washington, D. C., 27 Sep. 1976
(Contract W-7405-eng-26)
(CONF-760954-5) Avail: NTIS HC A03/MF A01

The behavior of intermediate test vessels under sustained load, as would be obtained in a large pressurized-water or boiling-water reactor system was investigated. Fracture tests of flawed vessels suggest that the demonstrations of leak without burst in the intermediate vessel tests, both hydraulic and pneumatic, are applicable to the evaluation of the behavior of reactor pressure vessels with similar flaw geometries under sustained load. The two vessels that ruptured in this way withstood pressures 2.15 to 2.75 times design pressure. These test pressures are above the ASME Boiler and Pressure Vessel Code allowable pressures for faulted conditions. ERA

N77-31551# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A STUDY OF LOCAL STRESS HISTORIES IN LOADED AND UNLOADED HOLES AND THEIR APPLICATIONS TO FATIGUE LIFE ESTIMATION
J. E. Moon, B. H. E. Perrett, and P. R. Edwards London Aeron. Res. Council 1977 37 p refs Presented at the SEE Intern. Conf. on Fatigue Testing and Design, London, 5-9 Apr. 1976 Supersedes RAE-TR-76090; ARC-37040: see N77-14519
(ARC-CP-1374; RAE-TR-76090; ARC-37040) Avail: NTIS HC A03/MF A01; HMSO £2; PHI

Local stress measurements in aluminum alloy specimens at open holes and pin-loaded holes of the same elastic stress concentration factor, under variable amplitude loading are presented. The companion specimen method was used and the results are interpreted with particular reference to fatigue life estimation. In addition the Neuber test, linear strain methods were used to make estimates of the local stress history for the case of the open hole. Companion specimen tests with an ascending-descending zero to peak stress sequence showed that there was no significant difference in local stress ranges or residual stresses between an open hole and a pin hole-loaded hole of the same stress concentration. A comparable Neuber test produced errors in both maximum local strains and residual stresses and ways of improving this method are discussed. The linear strain method in the form currently suggested by ESDU made poor estimates of residual stresses. Author (ESA)

N77-31552# Florida Dept. of Transportation, Gainesville. Office of Materials and Research.
DEVELOPMENT OF A PROCEDURE FOR EVALUATING FLEXIBLE PAVEMENTS IN FLORIDA Final Report
H. F. Godwin and R. L. McNamara Mar. 1976 47 p refs
(PB-255848/4; FHWA-RD-76-SO497; RR-193) Avail: NTIS HC A03/MF A01 CSCL 13B

Procedures for measuring pavement condition and rideability are presented. A mathematical correlation between longitudinal slope variance data obtained with the CHLOE profilometer and roughness as measured with the No. 890 Mays Ride Meter is given. Training of personnel in the factors that influence pavement performance is also discussed. The reproducibility of measurements by different personnel of structural defects was very favorable. It is shown that flexible pavements can be systematically evaluated and rated by using the procedure development. The procedure for evaluating flexible pavements in Florida was implemented in January, 1973. GRA

N77-31553# Naval Surface Weapons Center, White Oak, Md.
EVALUATION OF GCFR PCRV CONTAINMENT CAPABILITY Final Report, Jul. 1974 - Jun. 1976
Joseph G. Connor and Michael E. Giltrud 15 Apr. 1977 85 p refs
(AD-A039908; NSWC/WOL/TR-77-42) Avail: NTIS HC A05/MF A01 CSCL 11/2

An analytical evaluation of the containment capability of the Prestressed Concrete Reactor Vessel for the Gas Cooled Fast Breeder Reactor has been conducted. Displacement and stress predictions were made from NASTRAN finite element calculations which were consistent with static hydraulic loading tests of 1/20 scale PCRV models. This favorable comparison strengthens confidence in the results of NASTRAN calculations for static and transient loading of the full scale GCFR-PCRV. The NASTRAN results imply that a Core Disassembly Accident of 4000 MWsec

thermal energy release should be contained by the PCRV with only moderate cracking at the inside of the lower haunch. This value should be substantiated by experiment before further analysis is performed. GRA

N77-31554# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
DESIGN OF THICK-WALLED MULTIPLE OPENING CONDUITS TO RESIST LARGE DISTRIBUTED LOADS Final Report, 1 Jul. 1970 - 1 Nov. 1976
William L. Gamble Apr. 1977 43 p refs
(Contract DACW73-72-C-0065)
(AD-A039259; SRS-440) Avail: NTIS HC A03/MF A01 CSCL 11/2

The design of multiple opening reinforced concrete conduits suitable for use as waterways through and under large earth-fill dams is discussed. The loadings considered are given values, and are not a subject of this investigation. Vertical overburden pressures up to 30 k/square ft, corresponding to about 250 ft. of fill, are considered. The resultant structures have members with low span/depth ratios, and the analysis and design of these structures is discussed, in a number of steps. The idealization of the thick-walled structure into a frame of linear elements is discussed, with particular attention to the joint areas. The analysis of the idealized frame is then considered. After the basic analysis is done, moments, shears, and thrusts must be found for the critical cross sections, and the selection of these sections is discussed. A criterion for the shear strengths of the deep members used in the conduits is presented. This is based on tests of models done earlier in the investigation, and has been checked against the results of other deep beam tests. The flexural reinforcement and the detailing of the flexural steel are discussed. Author (GRA)

N77-31555# New York Univ., N. Y. Inst. of Mathematical Sciences.
WAVE PROPAGATION, THE DYNAMICS OF ELASTIC STRUCTURES AND STABILITY, AND NEUTRON TRANSPORT
Edward L. Reiss 1977 10 p
(Grant AF-AFOSR-2107-71)
(AD-A036565; AFOSR-77-0068TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

A total of nine investigators completed 32 research projects yielding 22 publications, 10 accepted or submitted, and 5 in preparation. Subject areas were structural analysis (12), wave propagation (13), fluid dynamics (5), and transport theory (5). Topics included higher order buckling in the presence of imperfections, dynamic instability, composite material, wave propagation through nonlinear and random media, vortex motion in fluids, the small mean free path approximation to the transport equations, etc. Asymptotic, perturbation and bifurcation techniques predominated. GRA

N77-31556# Aeronautical Research Council, London (England).
A SYSTEM FOR THE AXIAL LOADING OF CREEP SPECIMENS
J. N. Webb Mar. 1976 49 p Supersedes Report no. RAE-TR-76043 and ARC-36895
(AD-A041012; ARC-CP-1364) Avail: NTIS HC A03/MF A01 CSCL 11/6

The problem of eccentricity of loading is considered in relation to tensile creep testing. An alignment system has been developed to provide for the measurement and correction of the eccentricity of loading relative to the centre line of the test specimen. The repeatability of creep test data using this system over a period of several years is reviewed. Comparison with deliberately malaligned tests indicates that axiality of loading contributes significantly to the repeatability of creep testing. Author (GRA)

N77-31557# Battelle Columbus Labs., Ohio.
RESIDUAL STRESSES AT GIRTH-BUTT WELDS IN PIPES AND PRESSURE VESSELS Quarterly Progress Report, 15 Oct. 1976 - 15 Jan. 1977
E. F. Rybicki May 1977 68 p refs
(Contract AT(49-24)-0239)
(PB-267580/9; NUREG-0239) Avail: NTIS HC A04/MF A01 CSCL 13E

Mathematical models were developed for calculating the magnitude, direction, and distribution of residual stresses at girth-butt welds. Two distinct mathematical models are needed. First, since residual stresses at butt welds are thermally induced, a model to represent the transient temperature distribution for each weld pass is needed. Secondly, a stress analysis model that treats the temperature distribution as input and predicts stresses as a function of weld-pass geometry, material properties, and the geometry of the pipe is needed. GRA

N77-31558# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A SURVEY OF THE LITERATURE ON THE SIZE EFFECT ON MATERIAL STRENGTH Final Report, 1 Aug. 1972 - 30 Sep. 1976
H. Leon Harter Apr. 1977 455 p refs
(AD-A041535; AFFDL-TR-77-11) Avail: NTIS HC A20/MF A01 CSCL 20/11

Nearly 500 years ago, Leonardo da Vinci observed that long wires are weaker than short wires of the same diameter. The statistical theory of extreme values (weakest-link theory) plays a very important role in studies of the size effect; competing theories include the energy theory and the technological theory. Summaries are given of relevant publications identified in the course of a literature survey on the size effect. Since this survey was motivated by concern about the reliability of large composite aircraft structures, which are now coming into use, special attention is given to the size effect on composite materials and structures. An attempt is made to summarize the present state of knowledge and to identify unsolved problems requiring further research. GRA

N77-31078# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).
EVALUATION OF VIBRATION LEVELS AT THE PILOT SEAT CAUSED BY WING FLOW SEPARATION
J. Becker and K. Dau (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 28 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

N77-31080# British Aircraft Corp., Preston (England). Military Aircraft Div.
DYNAMIC LOADING OF AIRFRAME COMPONENTS
C. G. Lodge and M. Ramsey *In* AGARD Unsteady Airloads in Separated and Transonic Flow Apr. 1977 26 p refs (For primary document see N77-31073 22-01)
Avail: NTIS HC A12/MF A01

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-31559*# Columbia Univ., New York. Dept. of Geography.
APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGRO-ENVIRONMENTAL STUDIES Semiannual Progress Report
Kempton E. Webb, Colin J. High, and Jerry C. Coiner, Prinicpal Investigators 28 Feb. 1977 202 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Grant NsG-5080)
(E77-10204; NASA-CR-153969) Avail: NTIS HC A10/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N77-31560*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF REMOTE SENSING TO SELECTED PROBLEMS WITHIN THE STATE OF CALIFORNIA Annual Progress Report
Robert N. Colwell, Michael Cosentino, John E. Estes, and Leonard W. Bowden, Principal Investigators 1 May 1977 123 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-7220)
(E77-10205; NASA-CR-153970; SSL-Ser-18-Issue-52) Avail: NTIS HC A06/MF A01 CSCL 08F

The author has identified the following significant results. Computer-assisted classification of LANDSAT data resulted in ten spectrally unique classes. The average vegetation composition associated with each computer class is described, and results of analysis of variance are given to determine if the class composition was significantly different. Flood flow data will be used in the flood plain management program; peak flood flow information will also be used in the flood insurance program. LANDSAT data will be used by Kern County for reviewing proposed subdivisions and building construction.

N77-31561*# Norsk Polarinstitutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Final Report
Torgny E. Vinje, Principal Investigator Aug. 1977 47 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E77-10206; NASA-CR-153976) Avail: NTIS HC A03/MF A01 CSCL 08L

The author has identified the following significant results. This investigation indicates unexpected great variation in drift velocity of ice in the Fram Strait. During calm weather, the southward directed speed was observed to be 10 cm/s at 81 deg N at the end of April 1976. About a week later during conditions with northerly moderate winds, the speed increased to about 20 cm/s. It was also possible, for the first time, to determine the drift velocity at various positions across the Fram Strait. A predominance of parallelogram-like floes was observed during the early spring, and for the whole period April-July, there seems to be a minimum areal coverage of floes of an average size of about 60 sq km.

N77-31562*# National Research Council, Bangkok (Thailand).
THAILAND NATIONAL PROGRAMME OF THE EARTH RESOURCES TECHNOLOGY SATELLITE Final Report, Jun. 1975 - Jul. 1977
Sanga Sabhasri, Principal Investigator Jul. 1977 123 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E77-10207; NASA-CR-153971) Avail: NTIS HC A06/MF A01 CSCL 08B

The author has identified the following significant results. Accomplishments include the identification of a series of active alluvial fans along the margins of the Central Plain, the compilation of crop resources maps of central and eastern Thailand, and evaluation of the Purdue/LARS printout using unsupervised mode of an area near Bangkok. Results from LANDSAT 1 imagery and ground truth survey showed that Thailand existing forest in 1973 covered an area of approximately 37% of total land area. The last countrywide survey using aerial photographs at 1:60,000 scale conducted in 1961 gave the figure of 58%. Experience has shown many advantages of LANDSAT imagery over the conventional aerial photography in locating faults and fractures in the preparation of tectonic maps. Several rock types can also be identified from LANDSAT imagery.

N77-31563*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Quarterly Progress Report
Paul E. Baldridge, Principal Investigator 10 Mar. 1977 2 p ERTS
(Contract NAS5-22399)
(E77-10209; NASA-CR-153973; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N77-31564*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Quarterly Progress Report
Paul E. Baldridge, Principal Investigator 10 Jun. 1977 3 p ERTS
(Contract NAS5-22399)
(E77-10210; NASA-CR-153974; QPR-8) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Although the analysis of the results of presently - used methodology has showed inadequate correlation between the land use change and the various socio-economic factors, a system of analysis was produced that will aid in the future work in this area pointing out the adequacy of the land use data for producing models of desired accuracy. This testing methodology is applicable to other LANDSAT/land use interpretation systems.

N77-31565*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE COLORADO Final Report, 28 Feb. 1975 - 28 Apr. 1977
Daniel H. Knepper, Jr., Principal Investigator Jun. 1977 122 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20914)
(E77-10211; NASA-CR-153975) Avail: NTIS HC A06/MF A01 CSCL 08L

The author has identified the following significant results. Many avalanche hazard zones can be identified on LANDSAT imagery, but not consistently over a large region. Therefore, regional avalanche hazard mapping, using LANDSAT imagery, must draw on additional sources of information. A method was devised that depicts three levels of avalanche hazards according to three corresponding levels of certainty that active avalanches occur. The lowest level, potential avalanche hazards, was defined by delineating slopes steep enough to support avalanches at elevations where snowfall was likely to be sufficient to produce a thick snowpack. The intermediate level of avalanche hazard was interpreted as avalanche hazard zones. These zones have direct and indirect indicators of active avalanche activity and were interpreted from LANDSAT imagery. The highest level of known or active avalanche hazards was compiled from existing maps. Some landslides in Colorado were identified and, to a degree, delimited on LANDSAT imagery, but the conditions of their identification were highly variable. Because of local topographic, geologic, structural, and vegetational variations, there was no unique landslide spectral appearance.

N77-31566*# Texas A&M Univ., College Station. Remote Sensing Center.
APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Quarterly Progress Report, 13 Apr. - 13 Jul. 1977
J. W. Rouse, Jr., Principal Investigator 13 Jul. 1977 9 p ERTS
(Contract NAS5-20796)
(E77-10212; NASA-CR-154796) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N77-31567*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF AGRICULTURAL AND OTHER EARTH RESOURCES PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA Semiannual Status Report, 1 Jan. - 30 Jun. 1977
Robert E. Huke, Vincent M Malmstrom, Charles L. Dreke, Robert C. Reynolds, Richard W. Birnie, and Richard E. Stoiber, Principal Investigators 30 Jun. 1977 24 p refs ERTS
(E77-10213; NASA-CR-154797) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N77-31568*# California Univ., Davis. Dept. of Electrical Engineering.
A STUDY OF THE USE OF REMOTE SENSING DATA IN HYDROLOGIC ENGINEERING MODELS Progress Report
V. R. Algazi and M. Suk, Principal Investigators Jan. 1977 41 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-5092)
(E77-10214; NASA-CR-152574) Avail: NTIS HC A03/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-31569*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report
Robert N. Colwell, Principal Investigator 31 May 1977 314 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-05-003-404)
(E77-10215; NASA-CR-154798; SSI-Ser-18-Issue-44) Avail: NTIS HC A14/MF A01 CSCL 08B

The author has identified the following significant results. The effects on estimates of monthly volume runoff were determined separately for each of the following parameters: precipitation, evapotranspiration, lower zone and upper zone tension water capacity, imperviousness of the watershed, and percent of the watershed occupied by riparian vegetation, streams, and lakes. The most sensitive and critical parameters were found to be precipitation during the entire year and springtime evapotranspiration.

N77-31570*# Ecole Practique des Hautes Etudes, Paris (France).
THE FRENCH ATLANTIC LITTORAL AND THE MASSIF ARMORICAIN, PART 1 Final Report, Jan. 1975 - Mar. 1977
Fernand Verger, Principal Investigator, Jean-Marie Monget, O. Guerin, R. M. Poisson, and Y. Thomas Mar. 1977 148 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E77-10216; NASA-CR-154799; Rept-3) Avail: NTIS HC A07/MF A01 CSCL 08F

The author has identified the following significant results. For interpretation of Isle of Jersey imagery, two types of taxons were defined according to their variability in time. On the whole, taxons with a similar spectral signature were opposed to those with strongly varying spectral signature. The taxon types were low diachronic variations and strong diachronic variation. Imagery interpretation was restricted to the landward part of the Fromentine area, including the sand beaches which were often difficult to spectrally separate from the barren coastal dunes in the southern part of Noirmoutier Island as well as along the Breton marsh. From 1972 to 1976, sandbanks reduced in area. Two high river discharge images showed over a two year period an identical outline for the Bilho bank to seaward, whereas upstream, the bank has receeded in the same time to a line joining Paimboeuf to Montoir. The Brillantes bank has receeded at both ends, partly due to dredging operations in the access channel to Donges harbor.

N77-31571*# Ecole Practique des Hautes Etudes, Paris (France).
THE FRENCH ATLANTIC LITTORAL AND THE MASSIF ARMORICAIN, PART 3 Final Report
Fernand Verger, Principal Investigator, Jean-Yves Scanvic, and Jean-Marie Monget Jan. 1977 23 p refs Sponsored by NASA ERTS
(E77-10217; NASA-CR-154800; Rept-3) Avail: NTIS HC A02/MF A01 CSCL 08F

The author has identified the following significant results An original map of lineaments of the Armorican Massif and the Vendean platform was prepared. Validity of spatial information through comparison with maps of various kinds, such as geological, geophysical, morphological, etc., was verified. It was confirmed that LANDSAT images, in many cases, reflect data on deep phenomena which were only accessible geophysically and by means of borings. Tectonic domains were outlined, and known lineaments were extended.

N77-31572*# Southern Colorado Univ., Pueblo.
ELECTRON MICROPROBE STUDY OF LUNAR AND PLANETARY ZONED PLAGIOCLASE FELDSPARS Progress Report, 1 Feb. - 1 Jul. 1977
Robert K. Smith, Principal Investigator 15 Jul. 1977 11 p EREP
(Grant NsG-9051)
(E77-10218; NASA-CR-154801) Avail: NTIS HC A02/MF A01 CSCL 08G

There are no author-identified significant results in this report.

N77-31573*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Final Report, Mar. 1975 - Jun. 1977
W. J. VanderOord, Principal Investigator Jul. 1977 204 p refs Sponsored by NASA ERTS
(E77-10219; NASA-CR-154802; Rept-6) Avail: NTIS HC A10/MF A01 CSCL 05B

The author has identified the following significant results. The main vegetation units of the lower Mekong basin and the land development conditions were mapped by interpretation of LANDSAT 1 data. By interpretation of various shades of gray on satellite images, it was possible to map the density of the vegetation cover. Study of seasonal variations makes it possible to distinguish between mainly deciduous forests. In the Mekong basin area, these are generally related to the vegetation cover density.

N77-31574*# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY: PREPROJECT BASELINE Final Report
R. E. Riggins, Principal Investigator and J. R. Anderson May 1977 44 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-53875)
(E77-10220; NASA-CR-154803; CERL-TR-N-24) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. LANDSAT imagery can be used effectively as a baseline for detection of environmental change, resulting from construction of a major inland reservoir. Forest cover can be observed adequately on two-band composite enlargements at a scale of 1:130,000. Forest cover delineated on LANDSAT enlargements compares accurately with ground truth at a scale of 1:250,000. A dual image mapping technique superimposing winter, summer, and spring scenes using the zoom transfer scope facilitates the determination. The same technique can be used to detect changes in the project area, resulting from construction activities. High altitude aircraft imagery can also be used to interpret changes in land use and forest type.

Construction operations can be more clearly detailed on the air photos than on LANDSAT imagery.

N77-31575*# TRW Systems Group, Redondo Beach, Calif.
EXPERIMENTAL STUDY OF DIGITAL IMAGE PROCESSING TECHNIQUES FOR LANDSAT DATA Final Report, Apr. 1974 - Jan. 1976
S. S. Rifman, Principal Investigator, W. B. Allendoerfer, R. H. Caron, L. J. Pemberton, D. M. Mckinnon, G. Polanski, and K. W. Simon Jan. 1976 162 p refs Original contains imagery. Original photograhy may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20085)
(E77-10221; NASA-CR-152552; TRW-26232-6004-TU-01) Avail: NTIS HC A08/MF A01 CSCL 08B

The author has identified the following significant results. Results are reported for: (1) subscene registration, (2) full scene rectification and registration, (3) resampling techniques, (4) and ground control point (GCP) extraction. Subscenes (354 pixels x 234 lines) were registered to approximately 1/4 pixel accuracy and evaluated by change detection imagery for three cases: (1) bulk data registration, (2) precision correction of a reference subscene using GCP data, and (3) independently precision processed subscenes. Full scene rectification and registration results were evaluated by using a correlation technique to measure registration errors of 0.3 pixel rms thoughout the full scene. Resampling evaluations of nearest neighbor and TRW cubic convolution processed data included change detection imagery and feature classification. Resampled data were also evaluated for an MSS scene containing specular solar reflections.

N77-31576*# California Univ., Berkeley. Space Sciences Lab.
AN INVENTORY OF IRRIGATED LANDS FOR SELECTED COUNTIES WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Final Report, 15 Apr. 1975 - 15 Jan. 1977
Robert N. Colwell, Principal Investigator 15 Jan. 1977 61 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20969)
(E77-10222; NASA-CR-154805; SSL-Ser-18-Issue-50) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results: (1) Goals of the irrigated lands project were addressed by the design and implementation of a multiphase sampling scheme that was founded on the utilization of a LANDSAT-based remote sensing system. (2) The synoptic coverage of LANDSAT and the eighteen day orbit cycle allowed the project to study agricultural test sites in a variety of environmental regions and monitor the development of crops throughout the major growing season. (3) The capability to utilize multidate imagery is crucial to the reliable estimation of irrigated acreage in California where multiple cropping is widespread and current estimation systems must rely on single data survey techniques. (4) In addition, the magnitude of agricultural acreage in California makes estimation by conventional methods impossible.

N77-31577*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
LANDSAT INFORMATION FOR STATE PLANNING Final Technical Information
N. L. Faust and G. W. Spann (Metrics, Inc.) Jun. 1977 72 p refs Original contains color illustrations
(Contract NAS8-30653)
(NASA-CR-150378) Avail: NTIS HC A04/MF A01 CSCL 05B

The transfer of remote sensing technology for the digital processing of LANDSAT data to state and local agencies in Georgia and other southeastern states is discussed. The project consists of a series of workshops, seminars, and demonstration efforts, and transfer of NASA-developed hardware concepts and computer software to state agencies. Throughout the multi-year effort, digital processing techniques have been emphasized classification algorithms. Software for LANDSAT data rectification and processing have been developed and/or transferred. A hardware system is available at EES (engineering experiment station) to allow user interactive processing of LANDSAT data. Seminars and workshops emphasize the digital approach to LANDSAT data utilization and the system improvements scheduled for LANDSATs C and D. Results of the project indicate a substantially increased awareness of the utility of digital LANDSAT processing techniques among the agencies contracted throughout the southeast. In Georgia, several agencies have jointly funded a program to map the entire state using digitally processed LANDSAT data. Author

N77-31578# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF LANDSAT IMAGES IN THE MONITORING AND CONTROL OF THE CATTLE FARM PROJECTS ESTABLISHED IN THE AMAZON REGION
Armando Pacheco DosSantos and Evlyn Marcia Leao deMoraes Novo Jul. 1977 29 p refs In PORTUGUESE; ENGLISH Summary
(INPE-1075-NTE/101) Avail: NTIS HC A03/MF A01

LANDSAT system capability was evaluated for monitoring deforestation in cattle farms established in the Amazon region. Assessment of pasture quality was also within the scope of the work. Automatic and visual methods were used to quantitatively determine the deforested areas. Author

N77-31579# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGIC MAPPING OF THE GOIAS QUADRANGLE BASED ON THE MULTISPECTRAL IMAGES TRANSMITTED BY LANDSAT 1 SATELLITE M.S. Thesis [MAPEAMENTO GEOLOGICO DA FOLHA GOIAS AO MICIONESIMO BASEADO EM IMAGENS LANDSAT-1]
Edison Crepani and Paulo Roberto Martini Jul. 1977 111 p refs In PORTUGESE; ENGLISH summary
(INPE-1071-TPT/058) Avail: NTIS HC A06/MF A01

The usefulness of the multispectral images, transmitted by the LANDSAT-1 (formerly ERTS-1) spacecraft, for regional geological mapping is demonstrated. Besides using conventional imagery, use was also made of photographs from the SKYLAB Program and of computer compatible tapes (CCT's), automatically analysed in the IMAGE-100 (I-100) equipment. Eventually, black and white 70 mm transparencies were used. The selection of the Goias Quadrangle is due to the good quality of the orbital data available and to the acknowledged geological complexity, with multiple stratigraphic units and different geotectonic environments. Author

N77-31580# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THERMAL MAPPING OF THE SEA SURFACE USING VHRR COMPUTERIZED IMAGES OF THE NOAA SERIES OF SATELLITES M.S. Thesis [MAPEAMENTO TERMICO DA SUPERFICIE DO MAR UTILIZANDO IMAGENS DIGITALIZADAS VHRR DOS SATELITES DA SERIE NOAA]
Luiz Toshio Takaki Jul. 1977 80 p refs In PORTUGUESE; ENGLISH summary
(INPE-1072-TPT/059) Avail: NTIS HC A05/MF A01

A methodology for attainment of satelliteborne thermal mapping of the sea surface is presented. The images were obtained by means of the VHRR-IR (Very High Resolution Radiometer, Thermal Infrared) of the NOAA (National Oceanic and Atmospheric Administration) series of satellites. The following steps were taken: initially the main principles involved in the construction of a thermal map are presented. A brief description of the equipment and data processing utilized is given, including an approach to preprocess the data. It follows a detailed description of the construction of a thermal map and its radiometric angular correction. Main experimental results are presented and finally suggestions for future work in the field of thermal mapping of sea surface are given. Author

N77-31581# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
GEOMORPHOLOGIC MAPPING BY MEANS OF LANDSAT IMAGES [MAPEAMENTO GEOMORFOLOGICO ATRAVES DE IMAGENS DO LANDSAT]
Evlyn Marcia Leao DeMoraes Novo and Maria Amelia Leite Soares DoNascimento Jul. 1977 24 p refs In PORTUGUESE; ENGLISH summary

(INPE-1076-NTE/102) Avail: NTIS HC A02/MF A01

The selected test site was the area covered by the Belo Horizonte Chart. This area was chosen because it presents a variety of geomorphologic aspects that allows for the establishment of a procedure for image interpretation. The results showed that it is possible to characterize the main geomorphological features by means of LANDSAT image analysis. A map was constructed which can be used as an aid in further studies leading to the establishment of evolution models for landscape. Author

N77-31582# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

TECTONIC SKETCH MAP OF NORTHERN MINAS GERAIS BASED ON LANDSAT IMAGES [ESBOCO TECTONICO DO NOTRE DE MINAS GERAIS BASEADO EM IMAGENS LANDSAT]

Roberto Pereira DaCunha and Juercio Tavares DeMattos Jul. 1977 29 p refs In PORTUGUESE; ENGLISH summary

(INPE-1078-NTE/104) Avail: NTIS HC A03/MF A01

The results obtained from the interpretation of LANDSAT data for regional geological investigation are presented. RADAR imagery, aerial photographs and aeromagnetic maps were also used. Automatic interpretation, using LANDSAT CCT's, was carried out in the I-100 equipment. A tectonic map was constructed of an area of about 143.000 sq. km, in the central portion of Minas Gerais and eastern Goias States, known as potentially rich region in mineral resources. Author

N77-31583*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AN INTERACTIVE COLOR DISPLAY FOR MULTISPECTRAL IMAGERY USING CORRELATION CLUSTERING Patent Application

Richard E. Haskell, inventor (to NASA) (Oakland Univ., Rochester, Michigan) Filed 8 Sep. 1977 28 p Sponsored by NASA (Contract NAS9-14195)

(NASA-Case-MSC-16253-1; US-Patent-Appl-SN-831631) Avail: NTIS HC A03/MF A01 CSCL 20F

A method of and apparatus for processing multispectral data is provided which permits an operator to make parameter level changes during processing of the data. The system is directed to production of a color classification map on a video display in which a given color represents a localized region in multispectral feature space. Interactive controls permit an operator to alter the size and change the location of these regions, permitting the classfication of such regions to be changed from a broad to a narrow classification. NASA

N77-31584*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 2 EVALUATION REPORT

Jul. 1977 76 p

(NASA-TM-74937; JSC-11694; LACIE-00453) Avail: NTIS HC A05/MF A01 CSCL 02C

Documentation of the activities of the Large Area Crop Inventory Experiment during the 1976 Northern Hemisphere crop year is presented. A brief overview of the experiment is included as well as phase two area, yield, and production estimates for the United States Great Plains, Canada, and the Union of Soviet Socialist Republics spring winter wheat regions. The accuracies of these estimates are compared with independent government estimates. Accuracy assessment of the United States Great Plains yardstick region based on a through blind sight analysis is given, and reasons for variations in estimating performance are discussed. Other phase two technical activities including operations, exploratory analysis, reporting, methods of assessment, phase three and advanced system design, technical issues, and developmental activities are also included. Author

N77-31585# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

A COMPUTER ROUTING OF UNSATURATED FLOW THROUGH SNOW

Walter B. Tucker, III and Samuel C. Colbeck May 1977 44 p refs

(AD-A040121; CRREL-SR-7710) Avail: NTIS HC A03/MF A01 CSCL 08/8

Computer programs for routing the vertical movement of water through snow have been developed. Previously, manual graphical techniques were used, making calculation of the flow and shock front a very time-consuming procedure. The shock front is dependent on surface melt taking place now as well as the antecedent flow in the snow, usually a function of the nature of the flow for the previous day. One program, designed to accommodate actual surface melt data, has the ability to handle complicated input profiles such as when melt is erratic on a cloudy day, creating such complexities as intersecting shock fronts. Another program, designed for rapid simulation purposes, approximates a simple surface input with a function, in this case a sine wave. This function is easily changed, allowing a variety of conditions to be assessed, although only one shock front is accommodated. Error analysis and some applications of the programs are presented. Author (GRA)

N77-31586# Raytheon Co., Arlington, Va. Autometric Operation.

DESIGN OF A MAP UPDATE CAPABILITY FOR ENGINEER TOPOGRAPHIC UNITS Final Technical Report

May 1977 78 p

(Contract DAAG53-76-C-0176)

(AD-A041038; Rept-53-0200-0001; ETL-0107) Avail: NTIS HC A05/MF A01 CSCL 08/2

This report contains the final conceptual design of two systems for the compilation of Field Army map updates using all types of tactical reconnaissance imagery as data input. Both systems are capable of producing Class B output accuracy, and incorporate innovative design features to improve ease of operation and system throughput. One system is designed to perform a monoscopic solution where the map is used as a source of control to form a terrain model that is combined with the appropriate sensor model to transform image coordinates into their correct ground positions with relief displacement errors removed. The second system uses the mono solution for mono input imagery and a full analytical mapping solution for stereo input imagery. The systems: design evolution, theory of operations, technical characteristics, estimated costs, field deployed van layout, and cost effectiveness comparisons are presented. Author (GRA)

N77-31587# Rhode Island Univ., Kingston. Dept. of Chemistry.

IDENTIFICATION OF OIL SLICKS BY INFRARED SPECTROSCOPY Final Report, 1 Feb. 1974 - 15 Aug. 1976

Chris W. Brown, Patricia F. Lynch, and Mark Ahmadjian Aug. 1976 301 p refs

(Grant DOT-CG-81-74-1099)

(AD-A040975; USCG-D-19-77; CGR/DC-5/77) Avail: NTIS HC A14/MF A01 CSCL 17/5

This investigation evaluated the applicability of infrared spectroscopy to identifying sources of oil spills, using computer methods for matching spectra. Eighty-five different oils of all types were 'weathered' for two weeks in at least two of four weathering grids. Two of the grids were located on Narragansett Bay (one in the Bay and one onshore), and two at the University's Kingston laboratory (one inside, and one on the roof). Spectral data on approximately 900 weathered oil samples were digitized and stored in computer data files to form a library of weathered oils. These were then compared to some 300 spectra of their unweathered sources by a computer ratio method. The investigation showed that infrared spectroscopy coupled with computer analysis is a useful technique for identifying the source of spilled oil. By using artificial weathering techniques, the correct source of a spill can be identified by infrared with a high probability when samples are collected within one week of the original spill. GRA

N77-31588# Pattern Analysis and Recognition Corp., Rome, N. Y.

ADVANCED DIGITAL EXPLOITATION TECHNIQUES (ADET) Final Technical Report

George E. Forsen, Frank H. Feng, Michael J. Gillotte, John C. Lietz, and Dennis J. Lucey Apr. 1977 252 p

(Contract F30602-75-C-0141)

(AD-A040769; PAR-77-3; RADC-TR-77-145) Avail: NTIS HC A12/MF A01 CSCL 15/4

This effort developed and tested certain digital techniques that are applicable to the problem of tactical target detection using multispectral aerial photography. In addition key algorithms were provided for the Digital Interactive Complex for Image Feature Extraction and Recognition (DICIFER) located at RADC. Algorithms were designed and implemented to provide the capability for normalizing digitized image data. These include the following areas: radiometric and geometric corrections for the Computer Eye Digitization device, point-spread function correction, and registration program embellishments. A general purpose image-combinations program was also provided. A major task of this effort was the development of sensor/sun position and atmospheric correction programs. Experimental efforts included the digitization of multispectral imagery and generation of ground truth data. Automatic classification logic was designed and tested on a limited data set. This logic was successful in separating camouflaged tactical targets from vegetative backgrounds. Author (GRA)

N77-31589# Bureau of Mines, Denver, Colo. Mining Research Center.

GDIST: A COMPUTER CODE FOR ANALYSIS OF STATISTICAL DISTRIBUTIONS OF PHYSICAL DATA

J. R. Alldredge and D. D. Bolstad 1977 63 p refs

(PB-266762/4; BM-IC-8731) Avail: NTIS HC A04/MF A01 CSCL 08G

A computer code has been developed for describing and testing the statistical distribution of general continuous data sets. The statistical distributions used include the normal, lognormal, exponential, chi square, gamma, and uniform. Histograms for observed and expected values are plotted for each distribution. An example using geologic data obtained from a study of the geometric properties of natural fractures in oil shale rock illustrates the use of the computer program, GDIST. GRA

N77-31590# California State Dept. of Transportation, Sacramento.

REMOTE IDENTIFICATION OF GEOLOGIC MATERIALS BY MULTISPECTRAL TECHNIQUES: AN EVALUATION OF APPLICABILITY TO HIGHWAY PLANNING IN CALIFORNIA Final Report

James Gamble Sep. 1976 45 p refs Sponsored by Federal Highway Admin.

(PB-267137/8; FHWA-CA-TL-2117-76-57) Avail: NTIS HC A03/MF A01 CSCL 08M

The remote classification of terrain features and natural materials at a California test site, obtained by multisensor scanner and computer assisted processing techniques is compared to a detailed geologic map that served as ground truth for evaluating classification accuracy. The purpose of the study was to determine if the multispectral method of remotely discriminating natural materials had practical application for highway and environmental planning, and for route selection. GRA

N77-31591# Oak Ridge National Lab., Tenn.

THEORY AND ANALYSIS OF VEGETATION PATTERN Ph.D. Thesis

C. T. Kelsey, F. G. Goff, and D. Fields Jan. 1977 167 p refs

(Contract W-7405-eng-26)

(EDFB/IBP-76/3) Avail: NTIS HC A08/MF A01

Distortion in indirect gradient ordination was investigated and a technique less subject to distortion was developed that maintains a direct relationship between ecological differences between vegetation elements and ordination distances between those elements. The procedure was tested through application to species joint occurrence data (presence and absence data) from two adjacent physiographic regions, the Cumberland Plateau and the Ridge and Valley regions of Tennessee. ERA

N77-31592# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

DEVELOPMENT OF SNOW WATER EQUIVALENT SURVEY METHODS USING AIRBORNE GAMMA MEASUREMENTS Progress Report, Jan. - Sep. 1975

A. Fritzache and C. Jupiter 17 Oct. 1975 28 p refs

(Contract EY-76-C-08-1183)

(EGG-1183-1677) Avail: NTIS HC A03/MF A01

Airborne techniques for measurement of the water equivalent of snow and soil moisture are described. The work included a series of snow and soil moisture surveys and development of a new detector and data acquisition system. The status of this work is summarized here together with a review of plans for the immediate future. ERA

N77-31593# Thomson-CSF, Velizy (France). Div. Tubes Electroniques.

EVALUATION OF SPACE APPLICATION PROBLEMS OF A DECIMILLIMETER CARCINOTRON Final Report [EVALUATION DES PROBLEMS D'UTILISATION SPATIALE D'UN CARCINOTRON DECIMILLIMETRIQUE]

J. P. Desne, D. Grauleau, G. Kantorowicz, P. Palluel, M. Pontivianne, and A. M. Shroff May 1977 134 p refs Partly in FRENCH; partly in ENGLISH; partly in GERMAN

(Contract ESTEC-2925/76-NL-AK)

(RT-1814; ESA-CR(P)-963) Avail: NTIS HC A07/MF A01

The operation of a carcinotron as a local oscillator in a spaceborne far infrared heterodyne detection experiment was examined. A new model of the carcinotron was developed and tested, allowing broadband tunability in the 0.95-0.75 mm range, delivering the minimum 10 mW output power and having an improved power consumption with respect to previously existing tubes. Problems reviewed are: configuration of the power supplies, mass, volume, stabilization; mass reduction and vibrations; thermal map of the tube and cooling; stray magnetic field; cathode emission in view of operating lifetime. ESA

N77-31594# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

NUMERICAL STUDIES TO AID INTERPRETATION OF AN AIRBORNE VLF RESISTIVITY SURVEY

Steven A. Arcone Apr. 1977 18 p refs

(AD-A039904; CRREL-77-5) Avail: NTIS HC A02/MF A01 CSCL 08/7

Airborne resistivity surveys, which use the wavetilt phenomena of radiowaves, are used as a preliminary exploration technique to find suitable areas for either engineering investigations or geologic reconnaissance explorations. Survey results are usually presented as resistivity flight line profiles or as contour maps from which the interpretation or site selection process must be initiated. To aid in this process and provide additional understanding of the correlation between data obtained from airborne and ground surveys, an analysis was performed to determine a very-low-frequency airborne system's response to modelled resistivity anomalies assumed to occur at the surface of an idealized flat earth. Some of the assumptions used to simplify the analysis were based on the results of past surveys. The influences of survey altitude, anomaly size, and average ground resistivity upon airborne resistivity patterns were analyzed. The results show that the average resistivity of a region plays an important role in suppressing large resistivity contrasts for anomalies of approximately 1 sq. km. area. Curves are presented to separate the effects of resistivity contrast and anomaly size, and two examples are given to demonstrate how these curves may be applied to the results of actual surveys. Author (GRA)

N77-31595# National Materials Advisory Board, Washington, D. C.

A SCREENING FOR POTENTIALLY CRITICAL MATERIALS FOR THE NATIONAL STOCKPILE

1977 67 p refs Sponsored in part by Bureau of Mines and Dept. of Commerce

(Contract GS-00-DS(P)-94008)

(PB-267214/5; NMAB-329) Avail: NTIS HC A04/MF A01 CSCL 08I

Inorganic and organic source materials were reviewed in an attempt to identify potentially indispensable materials. Primary criticality was based upon short-term stockpiling needs; other aspects such as the impact of new energy developments, alternate sources, alternate materials or design, and conservation were considered. Surprisingly few additional materials could be identified clearly as being critical on a worldwide basis; however, after screening a broad spectrum of source materials, chromium, geranium, iridium rhenium, vanadium, and zirconium and hafnium were identified for a more detailed examination. Of these commodities, chromium stands out in importance on the basis of criticality. GRA

N77-31596# Geological Survey, Jackson, Miss. Water Resources Div.
WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1976 Annual Report, 1 Oct. 1975 - 30 Sep. 1976
1976 349 p Sponsored in part by Mississippi Board of Water Commissioners, Jackson
(PB-267754/0; USGS/WRD/HD-77/011; USGS/WDR/MS-76/1) Avail: NTIS HC A15/MF A01 CSCL 13B

Discharge records for 79 gaging stations, stage records for 15 of these gaging stations stage only records for 4 gaging stations, contents for 4 lakes and reservoirs, water quality for 20 gaging stations and 1 miscellaneous site, and water levels for 168 observation wells are presented. Also included are data for 138 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Mississippi. GRA

N77-31597# Inter-American Tropical Tuna Commission, La Jolla, Calif.
COMPARISON OF NOAA 3-4 VHRR IMAGERY AND LANDSAT MULTI-SPECTRAL SCANNER IMAGES WITH MARINE RESOURCE MEASUREMENTS Final Report
Merritt R. Stevenson, Forrest R. Miller, and Robert G. Kirkham Dec. 1976 124 p refs
(Grant NOAA-04-6-158-44043)
(PB-268674/9; NOAA-77051117) Avail: NTIS HC A06/MF A01 CSCL 08J

A comparison of satellite-derived data with observations made aboard the Natl. Marine Fisheries Service research vessel are discussed, particularly the procedures used for processing shipboard data. Results in the analysis of LANDSAT-1 Multi-Spectral Scanner (MSS) data over the Gulf of California are given. Careful evaluation of MSS data showed the need for further software development and computer programs were written to correct for image skew for both compressed and full resolution imagery. A cooperative coastal zone ocean color experiment is also reviewed. The details of processing the raw very high resolution radiometer infrared (VHRRIR) data are discussed, as are the results of a comparison of VHRRIR data and sea truth data. GRA

N77-31598# National Oceanic and Atmospheric Administration, Boulder, Colo. Office of the Director (ERL).
AN ADVECTION-DIFFUSION MODEL OF THE DOMES TURBIDITY PLUMES
Wilmot N. Hess and Walter C. Hess Nov. 1976 29 p refs
(PB-268713/5; NOAA-TR-ERL-382; OD-13; NOAA-77051813) Avail: NTIS HC A03/MF A01 CSCL 08J

A physical model using advection of the sediment plus horizontal diffusion plus settling of the fines by Stokes Law is used to calculate several cases of plume behavior. Typical surface plume densities are less than 1 milligram/liter except quite near the mining ship. The benthic blanket produced by the bottom plume will typically have thicknesses of less than 100 micrograms/sq cm. GRA

N77-31599# Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
MULTIPLE OBJECTIVE PLANNING: SMALL WATERSHEDS
D. Byers and W. Miller Jun. 1975 47 p refs
(Contract DI-14-31-0001-3586; OWRT Proj. B-042-IND(6))
(PB-268043/7; W77-08350; Bull-84) Avail: NTIS HC A03/MF A01 CSCL 13B

Multiple social goal decision making with reference to small watershed resource planning was studied. The empirical model developed is based on the West Boggs Creek Watershed in Martin and Daviess Counties in Indiana. The programming model consists of maximizing a linear objective function for net national benefits, subject to constraints for physical and institutional limits, discrete activities and incompatible activities. Tradeoffs between net national benefit and eight environmental components were identified and functional relations developed from the observations of trade-off ratios. The results indicated the activities and order of installation which would be most beneficial to improving environmental quality. GRA

N77-31600# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
LABORATORY INVESTIGATION OF RAINFALL RETENTION AND TRANSMISSION IN FRESH SNOW Final Report
William P. Ebaugh and David R. DeWalle Mar. 1977 169 p refs
(Contract NOAA-4-36722)
(PB-268703/6; NOAA-77051107) Avail: NTIS HC A08/MF A01 CSCL 08H

Rain-on-snow experiments were conducted using fresh snow samples in plexiglass cylinders. Measurements of rainfall quantity, rainfall temperature, snow depth, snow temperature, initial and final snow density, and snowpack out-flow were made during 44 rain-on-snow events conducted in a controlled temperature environmental chamber. Data collected for fresh snow were used to determine outflow lag times, liquid-water-holding capacities, and routing coefficients. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-31601* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL SHINGLE Patent
Americo F. Forestieri, Anthony F. Ratajczak, and Leroy G. Sidorak, inventors (to NASA) Issued 9 Aug. 1977 5 p Filed 24 Aug. 1976 Supersedes N77-10645 (15 - 01, p 0091)
(NASA-Case-LEW-12587-1; US-Patent-4,040,867; US-Patent-Appl-SN-717319; US-Patent-Class-136-89P; US-Patent-Class-52-173; RUS-Patent-Class-52-518; US-Patent-Class-136-89-AC) Avail: US Patent Office CSCL 10A

A solar cell shingle was made of an array of solar cells on a lower portion of a substantially rectangular shingle substrate made of fiberglass cloth or the like. The solar cells may be encapsulated in flourinated ethylene propylene or some other weatherproof translucent or transparent encapsulant to form a combined electrical module and a roof shingle. The interconnected solar cells were connected to connectors at the edge of the substrate through a connection to a common electrical bus or busses. An overlap area was arranged to receive the overlap of a cooperating similar shingle so that the cell portion of the cooperating shingle may overlie the overlap area of the roof shingle. Accordingly, the same shingle serves the double function of an ordinary roof shingle which may be applied in the usual way and an array of cooperating solar cells from which electrical energy may be collected.
Official Gazette of the U.S. Patent Office

N77-31602* + National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 12
Jan. 1977 335 p
(NASA-SP-7043(12)) Avail: NTIS HC E05 CSCL 10B

This bibliography lists 584 reports, articles, and other documents introduced into the NASA scientific and technical information system from October 1, 1976 through December 31, 1976. Author

N77-31603# Joint Economic Committee (U. S. Congress).
THE ECONOMICS OF SOLAR HOME HEATING
William D. Schulze (New Mexico Univ.) Washington GPO 1977 90 p refs Study for Joint Economic Comm., 95th Congr., 1st Sess., 13 Mar. 1977
(GPO-85-329) Avail: SOD HC $1.35

The feasibility of residential use of solar energy is presented. Its extensive application as a result of energy price decontrols or in areas of natural gas shortages is discussed. The economic incentive for solar energy conversion through low interest loans is outlined. G.D.H.

N77-31604# Grumman Aerospace Corp., Bethpage, N.Y. Material and Structural Mechanics.
A NON-AEROSPACE APPLICATION OF PLANS: PRELIMINARY STRUCTURAL DESIGN OF WIND TURBINE DIFFUSER
J. Crouzet-Pascal Mar. 1977 88 p refs
(Contract E(11)-2616)
(RM-629) Avail: NTIS HC A05/MF A01

A baseline design for a lightweight diffuser, its calculated weight, and the method employed to calculate the specific sizes in the design are described. Formulas are presented that permit the straightforward assessment of the effect on the diffuser weight, and the related cost of power generation, of changes in dimensions, material, or allowable deflections. It was established that for a scale variation in the over-all size of the diffuser, the cost of power generation attributable to the diffuser varies linearly with the diffuser front radius. It was also established that as compared to using aluminum, the cost would actually go up with standard strength steel but down with higher strength steel. Allowing the structure to be more flexible cannot yield a reduction in cost unless a change in material properties is allowed. Author

N77-31605*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME STUDIES ON A SOLID STATE SULFUR PROBE FOR COAL GASIFICATION SYSTEMS
K. T. Jacob (California Univ., Berkeley), D. Bhogeswara Rao, and Howard G. Nelson Aug. 1977 22 p refs
(NASA-TM-78428; A-7162) Avail: NTIS HC A02/MF A01 CSCL 21D

Measurements on the solid electrolyte cell (Ar + H(2) + H(2)S/CaS + CaF(2) + (Pt)//CaF(2)//(Pt) + CaF(2) + CaS/H(2) + H(2)+Ar) show that the emf of the cell is directly related to the difference in sulfur potentials established at the Ar + H(2) + H(2)S/electrode interfaces. The electrodes convert the sulfur potential gradient across the calcium fluoride electrolyte into an equivalent fluorine potential gradient. Response time of the probe varies from approximately 9 hr at 990 K to 2.5 hr at 1225 K. The conversion of calcium sulfide and/or calcium fluoride into calcium oxide is not a problem anticipated in commercial coal gasification systems. Suggestions are presented for improving the cell for such commercial applications. Author

N77-31606# Committee on Interstate and Foreign Commerce (U. S. House).
FEA: FINAL REPORTS ON OIL AND GAS RESOURCES, RESERVES, AND PRODUCTIVE CAPACITIES
Washington GPO 1977 80 p refs Hearing before Subcomm. on Oversight and Investigations of the Comm. on Interstate and Foreign Commerce, 94th Congr., 2d Sess., 6 Aug. 1976
(GPO-80-748) Avail: Subcomm. on Oversight and Investigations

The ability of the FEA to produce information unaffected by political considerations and produced independently of industry is examined. Emphasis is placed on estimates of natural gas and oil reserves. J.M.S.

N77-31607# Committee on the Budget (U.S. House).
ECONOMIC AND BUDGET IMPACT OF THE PRESIDENT'S ENERGY PROPOSALS
Washington GPO 1977 167 p refs Hearing before Comm. on the Budget, 95th Congr., 1st Sess., 29 Jun. 1977
(GPO-93-689) Avail: Comm. on the Budget

Conservation incentives in the form of tax credits, new taxes on gas guzzling cars, a crude oil equalization tax, taxes in industrial and utility use of natural gas and oil, and changes in natural gas pricing are discussed in terms of the impact on the American economy and the Federal budget. Although testimony is provided on the long-term budget and economic effects, primary focus is placed on the immediate impact for FY 1978. J.M.S.

N77-31608# Committee on Interstate and Foreign Commerce (U. S. House).
COMPILATION OF ENERGY-RELATED LEGISLATION. VOLUME 1: OIL, GAS, AND ELECTRIC POWER
Washington GPO 1977 291 p refs Rept. by Comm. on Interstate and Foreign Commerce, 95th Congr., 1st Sess., Mar. 1977
(GPO-80-323; Print-95-2) Avail: SOD HC $2.75

Legislation dealing with oil, gas, and electric power is presented. Emergency Petroleum Allocation Act of 1973, Trans-Alaska Oil Pipeline, Natural Gas Act, Alaska Natural Gas Transportation Act of 1976, Public Utility Holding Company Act of 1935, and the National Environmental Policy Act of 1969 are a few of the pieces of legislation presented. J.M.S.

N77-31609# Committee on Interstate and Foreign Commerce (U. S. House).
COMPILATION OF ENERGY-RELATED LEGISLATION. VOLUME 2: OTHER ENERGY LEGISLATION
Washington GPO 1977 335 p refs Rept. by Comm. on Interstate and Foreign Commerce, 95th Congr., 1st Sess., Mar. 1977
(GPO-80-324; Print-95-3) Avail: SOD HC $3.05

Legislation emphasizing energy policy and conservation as well as environmental protection is presented without discussion. J.M.S.

N77-31610*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ALUMINUM OR COPPER SUBSTRATE PANEL FOR SELECTIVE ABSORPTION OF SOLAR ENERGY AND THE METHOD OF PRODUCING SAID PANEL Patent Application
Marion L. Roberts, Max H. Sharpe, and Albert C. Krupnick, inventors (to NASA) Filed 31 Aug. 1977 23 p
(NASA-Case-MFS-23518-1; US-Patent-Appl-SN-829390) Avail: NTIS HC A02/MF A01 CSCL 10A

Panels for selectively absorbing solar energy were developed. An aluminum substrate, a layer of zinc thereon, a layer of nickel over the zinc layer and an outer layer of solar energy absorbing nickel oxide comprise one panel. A copper substrate with a layer of nickel thereon and a layer of solar energy absorbing nickel oxide distal from the copper substrate compose a second panel. A method for making aforesaid panels is disclosed. NASA

N77-31611*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STAINLESS STEEL PANEL FOR SELECTIVE ABSORPTION OF SOLAR ENERGY AND THE METHOD OF PRODUCING SAID PANEL Patent Application
Marion L. Roberts, Max H. Sharpe, and Albert C. Krupnick, inventors (to NASA) Filed 2 Sep. 1977 17 p
(NASA-Case-MFS-23518-2; US-Patent-Appl-SN-830382) Avail: NTIS HC A02/MF A01 CSCL 10A

A panel for selectively absorbing solar energy comprises a stainless steel metal substrate coated by a natural oxide of the metal. The panel is made by heating a cleaned stainless steel substrate in an oxygen-containing gas at 1500 - 1700 F. NASA

N77-31612*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA THERMIONIC-CONVERSION PROGRAM
James F. Morris 1977 9 p refs Presented at the 12th Intersoc. Energy Conversion Eng. Conf., Washington, D.C., 28 Aug. - 2 Sep. 1977; cosponsored by the IEEE, the Am. Inst. of Chem. Eng., the Am. Nucl. Soc., the Soc. of Automotive Eng., the Am. Chem. Soc., the AIAA, and the ASME
(NASA-TM-X-73644; E-9150) Avail: NTIS HC A02/MF A01 CSCL 10A

Technological processes in out-of-core thermionic energy conversion are described. The emphasis was on high temperature electrode materials and system engineering of converter geometries to produce practical power densities. I.M.

N77-31613*# Raytheon Co., Wayland, Mass. Microwave and Power Tube Div.
ELECTRONIC AND MECHANICAL IMPROVEMENT OF THE RECEIVING TERMINAL OF A FREE-SPACE MICROWAVE

POWER TRANSMISSION SYSTEM
William C. Brown 1 Aug. 1977 158 p refs
(Contract NAS3-19722)
(NASA-CR-135194; PT-4964) Avail: NTIS HC A08/MF A01 CSCL 10A

Significant advancements were made in a number of areas: improved efficiency of basic receiving element at low power density levels, improved resolution and confidence in efficiency measurements mathematical modelling and computer simulation of the receiving element and the design, construction, and testing of an environmentally protected two-plane construction suitable for low cost, highly automated construction of large receiving arrays. Author

N77-31614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF EXCITATION CONTROL FOR WIND-TURBINE GENERATOR STABILITY
Vernon D. Gebben Aug. 1977 16 p refs
(NASA-TM-73745; E-9313; ERDA/NASA/1028-77/3) Avail: NTIS HC A02/MF A01 CSCL 10B

High speed horizontal axis wind turbine generators with blades on the downwind side of the support tower require special design considerations to handle disturbances introduced by the flow wake behind the tower. Experiments and analytical analyses were made to determine benefits that might be obtained by using the generator exciter to provide system damping for reducing power fluctuations. Author

N77-31615# Boston Univ., Mass. Dept. of Chemistry.
PHOTON ENERGY STORAGE IN ORGANIC MATERIALS: THE CASE OF LINKED ANTHRACENES Technical Report, 1 Nov. 1975 - 31 Dec. 1976
Guilford Jones, II, William R. Bergmark, and Thomas E. Reinhardt 15 Mar. 1977 32 p refs
(Contract N00014-76-C-0442)
(AD-A039702; TR-6) Avail: NTIS HC A03/MF A01 CSCL 07/4

Criteria for the photochemical storage of solar energy as latent heat are outlined. Energy storing valence isomerizations which may be driven by irradiation and which may be reversed by heating with or without a catalyst are described. Data for photoisomerizations which utilize 300-500 nm radiation with storage capacities of 50-250 cal/g and with storage efficiencies of 5-10% are summarized. New data concerning linked anthracenes which photosiomerize with phi = 0.20.4 are provided. A photocalorimeter for the measurement of storage enthalpies is described. New systems for the practical conversion of solar energy are suggested. GRA

N77-31616# Army Construction Engineering Research Lab., Champaign, Ill.
USE OF THE BUILDING LOADS ANALYSIS AND SYSTEM THERMODYNAMICS PROGRAM TO PERFORM TOTAL ENERGY SYSTEM ANALYSIS Interim Report
Douglas C. Hittle Jun. 1977 21 p
(AD-A040744; CERL-IR-E-108) Avail: NTIS HC A02/MF A01 CSCL 13/1

This report describes a systematic procedure for applying the Building Loads Analysis and System Thermodynamics (BLAST) computer program to perform energy and life-cycle cost analyses of conventional, total energy, and selective energy systems as they might be applied to meet the energy demands of buildings or groups of buildings. The iterative application of this computer tool to permit the selection of nearly optimal candidate systems is described, and use of the program to estimate the performance of specific components during final plant design is outlined. The BLAST program and methods for its effective use are designed to support the engineering efforts required to implement guidance issued by the Office of the Chief of Engineers (Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy, and Heat Pump Systems, 1 July 1975). In addition to the prediction of space energy demand and the simulation of various air distribution systems, the BLAST program can simulate the performance of central energy supply systems consisting of any or all of the following components: diesel engine generators, gas turbine generators, steam turbine generators, centrifugal or reciprocator chillers, absorption chillers, double-bundle chillers (heat pumps), boilers, solar collectors, hot thermal energy storage, cold thermal energy storage, and utility company power. Author (GRA)

N77-31617# EIC, Inc., Newton, Mass.
LITHIUM-INORGANIC ELECTROLYTE BATTERIES Quarterly Progress Report, 1 Jan. - 31 Mar. 1977
Joseph R. Driscoll, Gerhard L. Holleck, Peter G. Gudrais, and S. Barry Brummer Jun. 1977 40 p refs
(Contract DAAB07-74-C-0030; DA Proj. 1T1-61102-A-34A) (AD-A041867; C-401; ECOM-74-0030-13; QPR-13) Avail: NTIS HC A03/MF A01 CSCL 10/3

The major area of investigation during this report period has been the voltage delay and depression in Li/SOCl2 cells after storage at 71 C. These are due to films on the Li anode surface which arise from reaction with the electrolyte. The effects of test-cell design and variation in storage procedures have been assessed. Calcium deposited onto the anode decreases the voltage delay. The efficiency of Ca deposition onto Li metal was investigated. An infrared spectrophotometric survey of the LiAlCl4/SOCl2 electrolyte system was initiated. The question of atmospheric exchange with the storage cells was explored. Argon-filled Al containers were used to store the cells. There was evidence of improvement in the Li/SOCl2 cells with regard to voltage delay up to 300 hours of storage. Infrared spectrophotometry was used to survey the LiAlCl4/SOCl2 electrolyte system. Eastman 246 SOCl2 contains -200 ppm HCl and SO2. After distillation, more SO2, and SO2Cl2, are detected. Water reacts with SOCl2 to produce SO2 and HCl in direct proportion to the amount added. Solutions of the electrolyte contain HC1, SO2 and hydroxy aluminum compounds. Storage of the electrolyte with Li removes HCl and hydroxy compounds but introduces low levels of other products. Water reacts with the electrolyte solution to produce SO2 and HCl and also hydroxy aluminum components. GRA

N77-31618# Argonne National Lab., Ill.
DESIGN AND PERFORMANCE OF Li-Al/IRON SULFIDE CELLS FOR UTILITY ENERGY STORAGE AND ELECTRIC VEHICLES
R. O. Ivins, E. C. Gay, W. J. Walsh, and A. A. Chilenskas 1976 27 p refs Presented at 27th Power Symp., Atlantic City, 21 Jun. 1976
(Contract W-31-109-eng-38)
(CONF-760617-3) Avail: NTIS HC A03/MF A01

Results of testing the laboratory-scale cells of prismatic configuration having electrodes fabricated by hot-pressing, electrochemical formation, or vibratory loading are presented. Prismatic cells were operated with specific energies of 115 V-h/kg at the 10-h discharge rate and specific powers of 140 W/kg at full charge and 100 W/kg at 50 percent discharge. Higher performance can be expected from improved cell designs which increase the ratio of electrode and active material weight to total cell weight, replacement of the ceramic fabric separators presently used by ceramic paper separators, and development of cells with lower electrical resistance. The choice of electrode fabrication techniques and cell designs for the second round of industrial contracts are described. The design and performance testing of the cells to date suggest that the technical program goals for both applications can be met. ERA

N77-31619# Sandia Labs., Albuquerque, N. Mex.
SOLAR COLLECTION MODULE TEST FACILITY, INSTRUMENTATION FLUID LOOP NUMBER ONE
T. D. Harrison, W. R. Dworzak, and C. A. Folkner, Jr. Jan. 1977 40 p
(Contract E(29-1)-789)
(SAND-76-0425) Avail: NTIS HC A03/MF A01

While data on mechanical, electrical, instrumentation, and fluid loops are not sufficient to enable complete planning for every possible test, they are judged adequate to enable initiation and completion on interface specifications with a minimum of additional data and effort. Fluid loop number one is designed to evaluate collectors and components of collectors using Therminol 66 as a heat transfer fluid. Fluid loop number one will deliver heat transfer fluid to the test item at temperatures from 20 C to 315 C (70 F to 600 F) at flow rates from 0.1 gpm to 10.0 gpm at pressures up to 0.51 MPa (75 psig). Fluid loop

number one has a weather station and an HP 2116 minicomputer which is capable of directing the test, acquiring data, and performing calculations. ERA

N77-31620# General Electric Co., Schenectady, N.Y.
DEMONSTRATION OF AN INDUCTOR MOTOR/ALTERNATOR/FLYWHEEL ENERGY STORAGE SYSTEM Quarterly Progress Report, 28 Jun. - 28 Sep. 1976
28 Sep. 1976 52 p
(Contract EY-76-C-02-4010)
(COO-4010-1; PR-1) Avail: NTIS HC A04/MF A01

Vehicle propulsion concepts utilizing flywheel energy are described. Analyses are presented for sizing an inductor motor/alternator/flywheel for application to a 3000 pound vehicle. Component tradeoffs are included for the inductor motor/alternator drive, the solid state inverter/rectifier, the control circuit, and a composite flywheel. Design specifications for the machine are established and a test plan defined. ERA

N77-31621# Brookhaven National Lab., Upton, N. Y.
ENERGY TRANSPORT CONTROL IN WINDOW SYSTEMS
A. L. Berlad, F. J. Salzano, and J. Batey 15 Sep. 1976 29 p refs
(Contract EY-76-C-02-0016)
(BNL-50586) Avail: NTIS HC A03/MF A01

Convection defeating apparatuses and techniques for window systems are described. It is found that selected convection defeating equipment may also be used for effective radiation and conductive control. Heat transfer measurements of initial window designs to confirm the utility and promise of the window systems were also studied. ERA

N77-31622# JAYCOR, Del Mar, Calif.
NUMERICAL OCEAN MODEL OF THE GULF OF MEXICO FOR EVALUATION OF THE ENVIRONMENTAL IMPACT OF OCEAN THERMAL POWER PLANTS
J. D. Thompson, H. E. Hurlburt, and L. B. Lin 1976 42 p refs Prepared in cooperation with NRL, Washington, D. C.
(Contract E(49-26)-1005)
(DSE/1005-3; NRL-GFD/OTEC-3-76) Avail: NTIS HC A03/MF A01

Studies of Ocean Thermal Power Plants (OTPP) effects on the far-field thermal gradient resource require a knowledge of the dynamics and thermodynamics of the time-dependent ocean. Short of actual OTPP operations, one can only assess the impact of OTPP's on the environment via longterm integrations of numerical ocean models. The best strategy for OTPP far-field modeling appears to be the selection of a single, well observed ocean basin with well defined boundary conditions and surface input data. A strategy for development of a hierarchy of models is presented, and basic requirements for a useful ocean model are outlined. ERA

N77-31623# Naval Research Lab., Washington, D. C. Geophysical Simulation Section.
RECIRCULATION AND THERMOCLINE PERTURBATION FROM OCEAN THERMAL POWER PLANTS
Steve A. Piacsek, Paul J. Martin, Juri Toomre, and Glyn O. Roberts (Science Appl., Inc., La Jolla, Calif.) 1976 26 p refs Presented in part at symp. on Energy from the Oceans: Fact or Fantasy, Raleigh, N. C., 27-29 Jan. 1976
(Contract E(49-26)-1005)
(DSE/1005-2; NRL-GFD/OTEC-2-76) Avail: NTIS HC A03/MF A01

Numerical experiments were performed on the fluid motions resulting from the pumping action of ocean thermal power plants. In particular, the resulting thermocline distortions, sea surface temperature decrease, and corresponding heat flow change were investigated. The results obtained to date use 2-D turbulent flow calculations. Near the engine, the sea surface temperature reduction ranges from 0.01 F to 3 F, depending on design, flow rate, season, and location. The mean temperature of the warm inflow water is reduced by up to 4 F from the mean temperature at that depth, for certain designs and flow rates, due to recirculation and turbulence. The far-field surface heat calculations applied to the Puerto Rico area show that a depression of the sea surface temperature by 0.1 C leads to an increased heat flow from air to sea of 9.6 cal/sq cm/day. ERA

N77-31624# Boeing Co., Seattle, Wash. Engineering and Construction Div.
CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM: COLLECTOR SUBSYSTEM Annual Technical Progress Report
14 Nov. 1976 45 p refs
(Contract EY-76-C-03-1111)
(SAN/1111-76-4) Avail: NTIS HC A03/MF A01

Details of the collector subsystem design for both the Pilot Plant preliminary design (PD) baseline and research experiments are given. As part of this effort, three heliostats and a drive and control assembly are being fabricated and tested to provide design data and verification of the PD. In addition, an extensive evaluation program is being conducted on the key plastic materials used in the protective enclosure and reflector. Performance tests on large-scale heliostats are being conducted at a desert test site in northeast Oregon. Items completed during the past quarter include: fabrication of protective enclosures (domes) and reflectors; installation and initiation of environmental testing of two domes at Boardman, Oregon; and a major portion of assembly/integration tests on the collector subsystem, including domes, reflectors and the drive and control assembly. ERA

N77-31625# United Engineers and Constructors, Inc., Philadelphia, Pa.
ASSESSMENT OF THE FEASIBILITY OF ADVANCED STEAM POWER PLANT CYCLES UTILIZING ATMOSPHERIC FLUIDIZED BED STEAM GENERATION AND HEATING, TASK 1 Final Report
S. W. Kight, Jr. and D. D. Rosard (Westinghouse Electric Corp., Lester, Pa.) Dec. 1976 184 p refs
(EPRI Proj. 582-1)
(EPRI-FP-317) Avail: NTIS HC A09/MF A01

It has been suggested that the fluidized bed boiler might open the way to more efficient steam cycles, using higher temperatures. This project was initiated to see whether there were other factors, particularly in the steam turbine, that would restrict the development of advanced steam plant using existing or near future technology. The study shows that the fabrication of very large high quality rotor forgings in super alloys suitable for high temperature service is the major obstacle. This, and other problems are discussed in detail. Steam temperatures to 1100 F could be attained using stainless steel superheater tubing and 1200 F with nickel based alloys. This steam admission temperature range could be utilized in a turbine with an alloy steel rotor provided that the first stage nozzle temperature drop ensured a rotor admission temperature of 1100 F. ERA

N77-31626# United Engineers and Constructors, Inc., Philadelphia, Pa.
PRELIMINARY ASSESSMENT OF ECONOMICS OF HYDROGEN PRODUCTION FROM LAWRENCE LIVERMORE LABORATORY ZnSe THERMOCHEMICAL CYCLE
Sep. 1976 239 p refs
(Contract W-7405-eng-48)
(UCRL-13711; UEC-LLL-760920) Avail: NTIS HC A11/MF A01

The ZnSe H2 Process is a multi-step thermochemical cycle which involves novel selenium-based chemistry and offers, in principle, the possibility of higher energy efficiency than competitive processes based on water electrolysis. A high temperature heat source such as provided by a gas-cooled nuclear reactor is required. The process in the 60,000 lb/hr reference plant design is 26 percent efficient. The H2 cost is about $28/MM Btu. This amount is considerably above the $5-8/MM Btu estimate for other reported processes for hydrolysis of water. The bulk of the product cost is in capital cost fixed charges. The conceptual capital cost estimate is $3,100 million, consisting of $900 million for the UHTR (Ultra High Temperature Reactor) heat source, and $2,200 million for the ZnSe H2 process. Selenium and molybdenum availability may be limitations on full scale implementation of the process. ERA

N77-31627# Mitre Corp., McLean, Va. METREK Div.
ECONOMIC ANALYSIS OF SOLAR WATER AND SPACE HEATING
Nov. 1976 312 p refs
(Contract EX-76-C-01-2322)

(DSE/2322-1-Suppl) Avail: NTIS HC A14/MF A01

Based on comparison with conventional energy costs, solar water heating and solar space heating installed at an equivalent system cost of $20 per square foot of collector is competitive today against electric resistance systems throughout most of the U.S. If the system cost is reduced to $15 per square foot, solar systems become competitive against oil hot water heating and/or oil and electric heat pump space heating in many cities. Finally, if the cost should be reduced to $10 sq ft by 1980 through a combination of technical innovations and incentives, solar hot water and heat would be economically competitive against all residential fuel types. Solar system designs for 13 cities were optimized so as to minimize the life cycle cost over the assumed 20 year life time of the solar energy systems. The major assumptions regarding the solar system, type and use of buildings, financial considerations, and economic environment used in the design optimization are given. ERA

N77-31628# California Univ., Livermore. Lawrence Livermore Lab. Energy and Planning Resource Group.

OIL, GAS, URANIUM, AND THORIUM: SUPPLY AND DEPLETION, WITH SPECIAL REFERENCE TO CALIFORNIA

I. Y. Borg, Randolph Stone, and Kenneth P. Puchlik 24 Dec. 1976 239 p refs Sponsored in part by State Energy Resources and Develop. Comm.

(Contract W-7405-eng-48)

(UCRL-52180) Avail: NTIS HC A11/MF A01

The assessment of global resources of gas, oil, uranium, and thorium with emphasis on California is presented. The forecasting of depletion is presented for the resources from the historical production data, the estimate of future production, and the size of the total resource available. Detailed data are provided under the following chapters: methodology; oil supplies; oil depletion forecasts; natural gas supplies; natural gas depletion forecast; uranium supplies; uranium depletion; thorium supply and depletion; and finally, a chapter on new work, new appraisals of reserves and undiscovered resources, and new studies on pipeline routes that promise to affect national and state planning. ERA

N77-31629# Energy Research and Development Administration, Washington, D.C.

MANAGEMENT PLAN FOR ENHANCED OIL RECOVERY. VOLUME 1: PROGRAM STRATEGY

Feb. 1977 358 p refs

(ERDA-77-15/1-Vol-1) Avail: NTIS HC A16/MF A01

Development of the base, selection of the five major classes of possible ERDA strategies for analysis, identification of technical and geographical targets for enhanced oil recovery (EOR) initiatives, determination of the feasible set of EOR programs, and prioritization of the candidate EOR programs and development of a recommended 5 year EOR budget are outlined. ERA

N77-31630# Sandia Labs., Albuquerque, N. Mex.

NATURAL GAS MASSIVE HYDRAULIC FRACTURE RESEARCH AND ADVANCED TECHNOLOGY PROJECT Quarterly Report, Aug. - Oct. 1976

C. L. Schuster, ed. Jan. 1977 27 p

(Contract EY-76-C-04-0789)

(SAND-76-0723) Avail: NTIS HC A03/MF A01

A massive hydraulic fracture experiment was conducted in West Virginia that was one of the field demonstrations of the Eastern Devonian Shale Program. It was the largest gelled water and proppant fracture conducted to date in the eastern United States. The system performed according to design goals after some minor revisions. Data analysis of the results are not very definitive for fracture orientation and some improved techniques are being planned for the follow-on experiments. ERA

N77-31631# Oak Ridge National Lab., Tenn.

LOW-TEMPERATURE THERMAL ENERGY STORAGE Quarterly Progress Report, Jul. - Sep. 1976

H. W. Hoffman and R. J. Kedi 31 Jan. 1977 23 p

(Contract W-7405-eng-26)

(ORNL/TM-5795) Avail: NTIS HC A02/MF A01

At ORNL, research efforts were continued to (a) develop a time-dependent analytical model that will describe a TES system charged with a phase-change material, (b) measure thermophysical properties and melt-freeze cyclic behavior of interesting PCM's and (c) determine crystal lattice structures of hydrated salts and their nucleators. A report on TES subsystems for application to solar energy sources was completed and is being reviewed. In the area of program management, subcontracts were signed. Detailed reviews were completed for ten unsolicited proposals related to TES. Industries, research institutions, universities, and other national laboratory participation in the TES program, for which ORNL has management responsibilities, are listed. ERA

N77-31632# Battelle Columbus Labs., Ohio.

HEAT SOURCE COMPONENT DEVELOPMENT PROGRAM Quarterly Report, Oct. - Dec. 1976

William M. Pardue, ed. Jan. 1977 81 p refs

(Contract W-7405-eng-92)

(BMI-X-676) Avail: NTIS HC A05/MF A01

Components for advanced radioisotope heat source applications to be used in advanced static and dynamic power conversion systems are outlined. The specific component development efforts which are described are: improved selective and nonselective vents for helium release from the fuel containment; and improved reentry members; and an improved impact member, singly and combined. The unitized reentry-impact member under development is to be used as a bifunctional ablator. Finally, thermodynamic supporting studies are reported. ERA

N77-31633# Electric Power Research Inst., Palo Alto, Calif.

PROCEEDINGS OF THE WORKSHOP ON ANALYSIS OF 1974 AND 1975 POWER GROWTH

Milton F. Searl and Albert N. Halter Dec. 1976 323 p refs Conf. proc. held at Chicago, 19-20 May 1976

(EPRI-EA-318-SR; Conf-760595; WS76-52) Avail: NTIS HC A14/MF A01

The causes of the low rate of growth in electric power output in 1974 and 1975 are examined. The subject is examined at various levels of aggregation by persons with various institutional affiliations including individual electric utilities. Perspective on national and regional growth in these years is provided by paper industry, by power equipment manufacturers with a major stake in the growth of the industry, by a regional electric reliability council representative, by a member of the staff of the Federal Energy Administration, and by an econometrician from the Electric Power Research Institute. The relationship between electricity output and the index of industrial production is discussed. ERA

N77-31634# Oak Ridge National Lab., Tenn. Engineering Technology Div.

COAL-FIRED ALKALI METAL POWER SYSTEM DESIGN STUDY Technical Progress Report, 1 Oct. - 31 Dec. 1976

Garland Samuels Feb. 1977 9 p

(Contract W-7405-eng-26)

(ORNL/TM-5800) Avail: NTIS HC A02/MF A01

Physical and thermodynamic properties of potassium and cesium were compiled. A series of potassium and cesium turbine designs were analyzed and cycle efficiency for both fluids were determined for a variety of operating conditions. ERA

N77-31635# Brookhaven National Lab., Upton, N. Y. Dept. of Applied Science.

HYDROGEN-HALOGEN ENERGY STORAGE SYSTEM: PRELIMINARY FEASIBILITY AND ECONOMIC ASSESSMENT

S. Srinivasan, R. S. Yeo, and A. Beaufrere 1976 7 p refs

(Contract EY-76-C-02-0016)

(BNL-22164) Avail: NTIS HC A02/MF A01

The hydrogen-chlorine (He-Cl2) cell has been suggested as an electric energy storage battery. Recently, this system was proposed for energy storage applications in electric utilities with the following advantages over the batteries and the hydrogen-oxygen (H2-O2) system which is being considered for the same purpose: (1) since the electrode reactions of H2 and Cl2 are quite reversible, one can expect an overall efficiency (electric yields electric) of over 75 percent (2) the same electrodes can be used as electrocatalysts in both modes (chemical and electricity generation). Therefore, the same electrochemical cell can be used for both functions, which reduces the capital costs; and

(3) the reactants for chemical and electricity generation are stored outside the cell which appears beneficial for a weekly cycle. A preliminary technical and economic feasibility assessment of the hydrogen-halogen battery as an electric energy storage system was undertaken and results are presented. ERA

N77-31636# Public Service Electric and Gas Co., Newark, N. J.
ASSESSMENT OF ENERGY STORAGE SYSTEMS SUITABLE FOR USE BY ELECTRIC UTILITIES, VOLUME 3 Final Report
Jul. 1976 112 p refs
(Contract E(11-1)-2501)
(EPRI-EM-264-Vol-3) Avail: NTIS HC A06/MF A01

The current state of development for conventional and underground pumped hydroelectric power was investigated. Hydroelectric pumped storage was found to be a mature technology, easily implemented where suitable sites are available for two surface reservoirs. It was stated that underground reservoirs extend areas where hydroelectric pumped storage can be used and further development of high head equipment is necessary for use in high head underground plants. ERA

N77-31637# Lewin and Associates, Inc., Washington, D. C.
RESEARCH AND DEVELOPMENT IN ENHANCED OIL RECOVERY. PART 1: OVERVIEW Final Report
Washington, D. C. ERDA Dec. 1976 132 p refs 3 Vol.
(Contract EX-76-C-01-2294)
(ERDA-77-20/1) Avail: NTIS HC A07/MF A01

Petroleum dependence and enhanced oil recovery: approach to the analysis; industry's plans for enhanced oil recovery; publicly sponsored R and D in enhanced oil recovery (total estimated production); and analyses for decision making are discussed. ERA

N77-31638# Battelle Columbus Labs., Ohio.
SURVEY OF THE APPLICATIONS OF SOLAR THERMAL ENERGY SYSTEMS TO INDUSTRIAL PROCESS HEAT. VOLUME 3: SOLAR THERMAL ENERGY SYSTEMS ANALYSIS AND PRELIMINARY ASSESSMENT OF RELATED NONTECHNICAL ISSUES Final Report
Jan. 1977 258 p refs Prepared in cooperation with Honeywell, Inc.
(Contract W-7405-eng-92)
(TID-27348/3-Vol-3) Avail: NTIS HC A12/MF A01

The application of solar thermal energy systems to industrial process heat is presented. The details and results of the analysis of the expected performance of solar thermal energy systems designed to supply industrial process heat are presented. The results of a preliminary assessment of nontechnical issues related to the use of solar energy for process heat i.e., economic, institutional, legal, and environmental aspects are also discussed. ERA

N77-31639# Battelle Columbus Labs., Ohio.
SURVEY OF THE APPLICATIONS OF SOLAR THERMAL ENERGY SYSTEMS TO INDUSTRIAL PROCESS HEAT. VOLUME 2: INDUSTRIAL PROCESS HEAT SURVEY Final Report
Jan. 1977 539 p refs Prepared in cooperation with Honeywell, Inc. 2 Vol.
(Contract W-7405-eng-92)
(TID-27348/2-Vol-2) Avail: NTIS HC A23/MF A01

The detailed results of a survey of the process heat requirements in 20 industries are presented. On the basis of detailed process analysis, a total process heat requirement of 7.87 x 10 to the fifteenth power Btu/year has been identified. Not all of industry is covered by these extrapolations, hence these quantities represent minimum values rather than totals for all of industry. Growth projections for each of the industries applied to the extrapolated 20 industry data lead to total process heat quantities of 12.4 x 10 to the fifteenth power and 16.8 x 10 to the fifteenth power Btu/year for 1985 and 2000, respectively, and to 4.3 and 5.9 x 10 to the fifteenth power Btu/year for the same years for the quantities used below 350 F. ERA

N77-31640# Utah Univ., Salt Lake City. Lab. of Environmental Radioactivity.
COMPARATIVE LEVELS OF ENVIRONMENTAL RADIOACTIVITY IN UTAH FROM INDUSTRY AND FALLOUT
1976 236 p refs
(Contract E(26-1)-0462)
(UERL-3) Avail: NTIS HC A11/MF A01

Radioactivity in air, vegetation, soil and wild animals in Utah was determined, and results are presented. Methods for continuous measurement of the daughter products of radon and thoron were developed. ERA

N77-31641# Utah Univ., Salt Lake City. Lab. of Environmental Radioactivity.
COMPARATIVE LEVELS OF RADIOACTIVE AIR POLLUTANTS FROM INDUSTRY AND FALLOUT. RADIOECOLOGICAL INVESTIGATIONS OF AIRBORNE RADIOACTIVITY IN THE UTAH ENVIRONMENT Progress Report
R. C. Pendleton 31 May 1972 350 p refs
(Contract E(26-1)-0462)
(UERL-1) Avail: NTIS HC A15/MF A01

Measurements carried on during the year 1971 and the first two months of 1972 on the radioactivity from natural as compared to artificial radiation sources in the environment in Utah are reported. Responses of air monitors in relationship to the ventilation index, seasonal effect, and the industrial complexity of the area were analyzed. Continuous measurements were made of the levels of radioactive materials in soils and vegetation and the results presented in tabular form. ERA

N77-31642# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: GEOTHERMAL; ENERGY FROM THE EARTH
John W. Shupe 1976 68 p Workshop held in San Francisco, 21 Sep. 1976
(TID-27431) Avail: NTIS HC A04/MF A01

Some of the following topics were discussed at the workshop on geothermal energy; (1) geothermal sources in Hawaii; (2) the philosophy of geothermal energy as an exotic alternative energy soruce; (3) geothermal development in the Imperial Valley; (4) legal impediments to geothermal development with special comments on the Geothermal Steam Act 1970. B.B.

N77-31643# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: CAN THE INDIVIDUAL'S VOICE BE HEARD; PUBLIC PARTICIPATION IN ENERGY PLANNING
Sylvia Siegel 1976 96 p Workshop held in San Francisco, 21 Sep. 1976
(TID-27433) Avail: NTIS HC A05/MF A01

The activities and duties of T.U.R.N., a consumer representation group are reported. Several views of various agency heads are presented in relation to consumer influence on energy supply and conservation measures as a part of ERDA's decision making process. B.B.

N77-31644# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: THE FOSSIL OPTION
1976 46 p Workshop held in San Francisco, 21 Sep. 1976
(TID-27430) Avail: NTIS HC A03/MF A01

The environmental impact of increased coal usage was examined, as well as the problems encountered by coal companies in recent years. Research was presented on alternate energy sources, especially that regarding the bituminous sandstones prevalent in California. A coal desulfurization project being conducted using powdered iron, coal, and fuel oil was examined and the space shuttle project and a methane-driven-automobile project were briefly mentioned. The direct use of coal was predicted as reaching 24 quads by the year 2000, with coal gasification and liquefaction moving to perhaps 14 quads; shale oil production could reach 7 quads. The results of a study on manufacturing gas or generating electricity were presented in which coal is used specifically for both processes. The efficiency from an energy

standpoint, cost to the consumer, and capital requirements were emphasized. ERA

N77-31645# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: WHAT IMPACT COULD ENERGY TECHNOLOGY DEVELOPMENT HAVE ON THE QUALITY OF LIFE
David O. Rankin 1976 71 p Workshop held in San Francisco, 22 Sep. 1976
(TID-27428) Avail: NTIS HC A04/MF A01

Religion versus science was discussed in terms of the quality of life. Other topics covered relating to this main theme included the impact of technological development, social processes, the need for education, and also human consciousness. ERA

N77-31646# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: GENERAL SESSION, VOLUME 2
Paul Valentine 1976 205 p Workshop held in San Francisco, 21 Sep. 1976
(TID-27427) Avail: NTIS HC A10/MF A01

Twelve presentations were made, divided into three subsessions: Session 1, Public Input to Energy Policy; Session 2, Energy Demand; and Session 3, Energy Supply. Panel discussions following each presentation are reported. ERA

N77-31647# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: FISSION AS AN OPTION
Roger Griffin 1976 84 p Workshop held in San Francisco, 21 Sep. 1976
(TID-27432) Avail: NTIS HC A05/MF A01

The ERDA-76 energy plan was discussed and criticized. It was emphasized that few options exist-specifically, nuclear and coal, in the near- and mid-term, however, concern was voiced regarding irreversible effects, commitments, and choices. Problems of U.S. energy policy planners with nuclear technology and finances were considered. In addition, the Colombo Resolution was discussed, a plan which would suspend debt payments to the International Monetary Fund and replace that with a development bank for emergency fusion power and agriculture-related industry. ERA

N77-31648# Energy Research and Development Administration, Washington, D.C.
ENERGY TECHNOLOGIES FOR THE WEST: ECONOMIC GROWTH AND ENERGY
William Hogan 1976 98 p Workshop held in San Francisco, 21 Sep. 1976
(TID-27429) Avail: NTIS HC A05/MF A01

The implementation and operation of formal models and analyses applied to energy problems were described, demonstrating the relationship between economic growth and energy demand and supply. Questions of energy supply and conservation practices were reviewed; the shortage of natural gas was seen as the most pressing issue in California. Comments were made regarding electric energy growth in the western states, giving attention to the energy consumption/GNP relationship. A group study was then presented which compares the economics of coal-fired and nuclear power plants. ERA

N77-31649# Little (Arthur D.), Inc., Cambridge, Mass.
NATIONAL BENEFITS/COSTS OF ENHANCED OIL RECOVERY RESEARCH Final Report
Aug. 1976 75 p
(Contract EX-76-C-01-2021)
(FE-2021-4) Avail: NTIS HC A04/MF A01

The primary type of benefit quantified is the national savings to be realized as a result of having cheaper supplementary oil available from enhanced recovery than would be otherwise available under uncertain alternative futures. Alternative types of benefits are also reviewed, including those associated with avoiding more expensive re-entry of stripper wells at a later time, with the balance of payments value of enhanced recovered oil, and with enhanced recovered oil becoming part of a national emergency stockpile. Other benefits unquantified are those associated with insurance and portfolio values. Sensitivity of the benefit/cost ratios to alternative assumptions is illustrated through a number of sensitivity analyses. These analyses indicate that the expected benefits from the development of enhanced oil recovery technology substantially exceed Federal program costs. ERA

N77-31650# Lewin and Associates, Inc., Washington, D. C.
RESEARCH AND DEVELOPMENT IN ENHANCED OIL RECOVERY. PART 2: THE PROGRAM Final Report
Dec. 1976 296 p
(Contracts EX-76-C-01-2294; E(49-18)-2294)
(ERDA-77-20/2) Avail: NTIS HC A13/MF A01

Steam drive, in-situ combustion, carbon dioxide miscible flooding, surfactant/polymer flooding, and polymer augmented waterflooding are discussed. ERA

N77-31651# Lewin and Associates, Inc., Washington, D. C.
RESEARCH AND DEVELOPMENT IN ENHANCED OIL RECOVERY. PART 3: THE METHODOLOGY Final Report
Dec. 1976 337 p
(E(49-18)-2294)
(ERDA-77-20/3) Avail: NTIS HC A15/MF A01

The criteria and procedures used in classifying the reservoir targets reflecting their technological status are discussed. The categories include assumptions used in analyzing the sensitivities of the results to alternate price/tax contingencies, results of the interviews with government officials and industry representatives, models used in the analysis to estimate incremental recovery and economics, and the development and use of the technological screening guide. ERA

N77-31652# Carnegie-Mellon Univ., Pittsburgh, Pa.
TRANSIENT BEHAVIOR OF A SOLAR SEA POWER PLANT
L. J. Dykstra and C. Zener Jul. 1976 91 p refs
(Contracts EY-76-S-02-2895; EY-76-S-02-2641; E(11-1)-2895; E(11-1)-2641)
(COO-2895-4; ERDA/SE/E(11-1)2895/TR/76/1) Avail: NTIS HC A05/MF A01

A first attempt at developing analytical models in the form of ordinary differential and auxiliary algebraic equations which describe the transient behavior of each component is detailed. These equations can be simulated on a digital computer to study the behavior of a complete plant so that the design of the plant accounts for the transient requirements. These models can be used directly or indirectly to design controllers for the plant and to develop the instrumentation requirements to implement closed-loop system control. ERA

N77-31653# Environmental Protection Agency, Washington, D.C. Div. of Solar Energy.
PHOTOVOLTAIC CONVERSION PROGRAM
Nov. 1976 109 p
(ERDA-76-161) Avail: NTIS HC A06/MF A01

A brief but comprehensive overview of the ERDA Photovoltaic Conversion Program is presented. It includes the program's goals and objectives, strategy, program plan, and abstracts of individual projects that comprise the program. ERA

N77-31654# Oak Ridge National Lab., Tenn. Engineering Technology Div.
SUMMARY REPORT: AN EXPLORATORY STUDY OF COST TARGETS FOR SOLAR ELECTRIC POWER PLANTS
T. D. Anderson, H. I. Bowers, J. G. Delene, L. C. Fuller, S. I. Kaplan, and J. V. Wilson Mar. 1977 34 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5787) Avail: NTIS HC A03/MF A01

A preliminary evaluation was made of the economic goals that need to be achieved in the solar-electric R and D and demonstration programs so that solar can become a viable component of our national electric energy production system. Solar electric technologies considered are: solar thermal conversion, solar photovoltaic, wind energy conversion, and ocean thermal. Target costs were developed for selected applications of solar by comparison with known means of accomplishing the

same end results. The known technologies were assumed to be fossil and nuclear energy sources. ERA

N77-31655# National Academy of Sciences - National Research Council, Washington, D. C.
NATIONAL RESEARCH COUNCIL COMMITTEE ON NUCLEAR AND ALTERNATIVE ENERGY SYSTEMS Interim Report
Jan. 1977 56 p
(Contract EX-76-C-10-3784)
(TID-27435) Avail: NTIS HC A04/MF A01

The need for and direction of nuclear power development, the various nuclear options being considered in detail, including breeder reactor and associated fuel-cycle technologies were studied. But decisions regarding nuclear energy cannot be made in a contextual vacuum: the time scale and the context in which these decisions should be made depend not only on the technical, social, and economic status and impacts of other energy-supply technologies, but also on assumptions concerning future levels of demand for energy and the possibilities for energy conservation through changes in consumption patterns and improved efficiency of the supply and end-use systems. The study, therefore, seeks to relate the many important factors that impinge on ERDA's and the nation's energy decisions and thereby on the ultimate role of nuclear power. ERA

N77-31656# Mathematica, Inc., Princeton, N. J.
COMPARATIVE STATE-OF-THE-ART ASSESSMENT OF GAS SUPPLY MODELING Final Report
Robert Ciliano, D. R. Limaye, and S. D. Hu Feb. 1977 643 p refs Sponsored by ERDA and EPRI
(EPRI-EA-201) Avail: NTIS HC A99/MF A01

A state-of-the-art comparison of twelve major gas-supply-modeling efforts is described. As categorized into three general classifications, namely:(1) structural models of resource economics, (2) pure econometric models; and (3) resource base-geologic models. In addition model-by-model assessments are presented. ERA

N77-31657# Sandia Labs., Albuquerque, N. Mex.
IMPURITIES IN CHEMICALLY SPRAYED CdS (Cu SUB x)S PHOTOVOLTAIC CELLS
R. S. Berg Feb. 1977 30 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0665) Avail: NTIS HC A03/MF A01

The levels of impurities found and their sources are described. Some of the effects of these impurities, as well as possible methods of eliminating some of them, are discussed. ERA

N77-31658# Army Electronics Command, Fort Monmouth, N.J.
A SOLAR POWER RADIACMETER
Joseph C. Nirschl Apr. 1977 28 p refs
(AD-A039995; ECOM-4495) Avail: NTIS HC A03/MF A01 CSCL 18/4

A solar power radiacmeter (breadboard) design is described, based on a miniature (18 cc) ionization chamber and low power, solid-state (Field Effect Transistor, FET) electrometer. Power demand for this instrument, including DC converter, is approximately 5 mW. Preliminary experiments with a 20 sq cm silicon solar cell panel and pen light (AA size) rechargeable (NiCd) battery suggest feasibility of this approach. Solar power intake and dissipation is discussed for experiments conducted. Author (GRA)

N77-31659# Ocean Data Systems, Inc., Monterey, Calif.
OCEAN THERMAL ENERGY CONVERSION: RESOURCE, ECOLOGICAL AND ENVIRONMENTAL STUDIES. THERMAL PROFILE ENVELOPES AND CROSS-SECTIONS FOR POTENTIAL OTEC PLANT SITES Interim Quarterly Report No. 3
William E. Hubert and Nathan L. Greenfeldt Feb. 1976 37 p
(Contract NSF C-1020)
(PB-266704/6; NSF/RA-760095) Avail: NTIS HC A03/MF A01 CSCL 08J

The most promising sites for Ocean Thermal Energy Conversion (OTEC) plants are examined. The three U.S.-controlled regions that show promise as sites for prototype OTEC installations are the Gulf Stream, Hawaiian Islands, and Puerto Rico. The environmental considerations of these sites are ocean temperature differences, current structure, and storm damage potential. GRA

N77-31660# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
A USER'S GUIDE TO THE MIT WORLD ENERGY DEMAND DATA BASE. PART 2: DATA INDEX
May 1976 172 p
(Grant NSF SIA-75-00738)
(PB-266830/9; MIT/EL-76/011WP-Pt-2;
NSF/RA-760474-Pt-2) Avail: NTIS HC A08/MF A01 CSCL 10A

This data base is assembled as part of an econometric study of world energy demand. The work is part of a project to develop analytical models of the world oil market. The data description listing is designed to be used both as a general index and as a reference key to the data base. It is concise enough to serve as an overview for an individual who wishes to determine what data is present, and it is indispensable to the on-line user who requires a guide to the mnemonics and abbreviations. GRA

N77-31661# Federal Highway Administration, Washington, D.C. Office of Energy Information and Analysis.
FEDERAL ENERGY INFORMATION LOCATOR SYSTEM: ENERGY INFORMATION IN THE FEDERAL GOVERNMENT
30 Nov. 1976 384 p
(PB-262331/2; FEA/B-76/492) Avail: NTIS HC A17/MF A01 CSCL 05B

This 1976 update has been prepared from a source survey conducted between August and November 1976. FEILS allows the user to identify Federal agencies collecting specific kinds of energy data and, therefore, to locate that data. The system itself does not contain the data available in the Federal Government; it is a directory for that data. GRA

N77-31662# Defence Research Establishment Ottawa (Ontario).
LITHIUM BATTERY SYSTEMS: EXAMINATION OF THE IODINE PENTOXIDE CATHODE
John R. Coleman and Gerard D. Nagy Jun. 1977 18 p
(AD-A041739; DREO-R-760) Avail: NTIS HC A02/MF A01 CSCL 10/3

The electrochemical system lithium-iodine pentoxide, attractive because of its high theoretical energy density, was investigated, employing as electrolyte a variety of salts dissolved in polar organic solvents. Iodine pentoxide blended with graphite and pressed on an expanded silver grid served as cathode; the anodes were made by pressing lithium ribbon onto an expanded nickel grid. GRA

N77-31663# AIA Research Corp., Washington, D. C.
EARLY USE OF SOLAR ENERGY IN BUILDINGS. A STUDY OF BARRIERS AND INCENTIVES TO THE WIDESPREAD USE OF SOLAR HEATING AND COOLING SYSTEMS
Aug. 1976 195 p refs
(Grant NSF APR-75-18339)
(PB-267832/4; NSF/RA-760578) Avail: NTIS HC A09/MF A01 CSCL 13A

The use of the technology and implementation of the knowledge in the building process is analyzed. A summary structure of incentives is also presented. The results of life cycle cost analyses of fifteen selected solar heating projects, as well as a general overview of the various economic factors relating to the commercialization of solar technology are evaluated. A regulatory analysis of sun rights and land use, building codes, warranties of performance, rights to energy, and the implications of these rights are discussed. GRA

N77-31664# Idaho Univ., Moscow. Dept. of Civil Engineering.
PUMPED STORAGE POTENTIAL OF THE HELL'S CANYON AREA M.S. Thesis
Larry Douglas Coupe Apr. 1977 143 p refs
(Contract DI-14-31-0001-5070; OWRT Proj. B-037-IDA(1))
(PB-267722/7; W77-08196) Avail: NTIS HC A07/MF A01 CSCL 10B

The potential for pumped storage hydroelectric development of the Hells Canyon area is reviewed with conclusions drawn

from preliminary investigation. Background information covers the concept and application of pumped storage, Hells Canyon's physical characteristics and history and its status as a National Recreation Area. Of eighteen potential storage sites noted, the three most promising are analyzed in detail. For each, preliminary designs were developed as well as computer analyses of the reservoir water level fluctuations that would result from such operations. Each is also analyzed for economic feasibility. Conclusions are that pumped storage in the area is too expensive to be competitive now, but it may be more feasible in the future. GRA

N77-31665# National Bureau of Standards, Washington, D. C.
COMPARISON OF COMPUTER-PREDICTED AND OBSERVED ENERGY USES IN A MULTI-FAMILY HIGH-RISE APARTMENT BUILDING Final Report
James P. Barnett and Stanley T. Liu Jun. 1977 38 p refs Sponsored by HUD
(PB-267829/0; NBSIR-76-1177) Avail: NTIS HC A03/MF A01 CSCL 10A

A comparison was made of the results of two computer programs, in predicting the energy consumption of a multi family high rise apartment building located in Omaha, Nebraska. Results are given on a monthly basis for the computed energy values and compared with average monthly values of metered data obtained over a five year period. GRA

N77-31666# New York State Assembly Scientific Staff, Albany.
SOLAR ENERGY APPLICATIONS AND RELATED LEGISLATION
Donald A. Mongitore May 1975 39 p refs Sponsored in part by NSF
(PB-267901/7; SS-503) Avail: NTIS HC A03/MF A01 CSCL 13A

Areas in which there is the greatest potential for state legislative action which would promote the use of solar energy in New York state are presented. Solar energy systems which have the greatest potential for use in New York state are described. The problems facing widespread implementation of these systems are enumerated, and legislative proposals which address these problems are detailed in light of existing legislation in other states and their impact on solar energy use in the state. GRA

N77-31667# Water Purification Associates, Cambridge, Mass. Science and Public Policy Program.
WATER REQUIREMENTS FOR STEAM-ELECTRIC POWER GENERATION AND SYNTHETIC FUEL PLANTS IN THE WESTERN UNITED STATES Final Report, May - Aug. 1976
H. Gold, D. J. Goldstein, R. F. Probstein, J. S. Shen, and D. Yung Apr. 1977 280 p refs
(Contract EPA-68-01-1916)
(PB-268067/7; EPA-600/7-77-037) Avail: NTIS HC A13/MF A01 CSCL 10B

Procedures are described for the detailed determination of the water consumed for mining and processing coal and oil shale, and for determining the residuals generated. The processes considered are Lurgi, Synthane, and Synthoil for coal conversion, TOSCO II for shale conversion, coal-fired steam electric power generation and slurry pipeline. In addition, determinations are also made of the water consumed for process cooling, flue gas desulfurization, revegetation of mined land, solids disposal and by evaporation and other uses within the mine-plant complex. GRA

N77-31207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
COMPARATIVE THERMODYNAMIC PERFORMANCE OF SOME RANKINE/BRAYTON CYCLE CONFIGURATIONS FOR A LOW-TEMPERATURE ENERGY APPLICATION
F. L. Lansing *In its* The Deep Space Network 15 Aug. 1977 p 156-167 (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-31668*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCESS FOR REMOVING SULFUR DIOXIDE FROM GAS STREAMS Patent Application
Jerry C. Poradek and D. Dixon Collins, inventors (to NASA) (Chemsoil Corp., Bakersfield, Calif.) Filed 19 Aug. 1977 15 p Sponsored by NASA
(Contract NAS9-14639)
(NASA-Case-MSC-16299-1; US-Patent-Appl-SN-826203) Avail: NTIS HC A02/MF A01 CSCL 13B

A process is described for removing sulfur dioxide from gas streams using an aqueous scrubbing medium containing a relatively small amount (less than 1200 parts per million) of iron as an oxidation catalyst. The scrubbing is conducted at a temperature range of from approximately 120 to 160 F for a period of time sufficient to permit substantial oxidation of the SO2. NASA

N77-31669*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GROUND CLOUD EFFLUENT MEASUREMENTS DURING THE MAY 30, 1974, TITAN 3 LAUNCH AT THE AIR FORCE EASTERN TEST RANGE
Richard J. Bendura and Kenneth H. Crumbly Washington Sep. 1977 50 p refs
(NASA-TM-X-3539; L-11372) Avail: NTIS HC A03/MF A01 CSCL 13B

Surface-level exhaust effluent measurements of HCl, CO, and particulates, ground-cloud behavior, and some comparisons with model predictions for the launch of a Titan 3 rocket are presented along with a limited amount of airborne sampling measurements of other cloud species (O3, NO, NOX). Values above background levels for these effluents were obtained at 20 of the 30 instrument sites; these values were lower than model predictions and did not exceed public health standards. Cloud rise rate, stabilization altitude, and volume are compared with results from previous launches. Author

N77-31670# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION: NOISE POLLUTION, SONIC BOOM Report Bibliography, Apr. 1959 - Jul. 1976
Jun. 1977 201 p refs Supersedes DDC-TAS-73-74
(AD-A041400; DDC/BIB-77/06; DDC-TAS-73-74) Avail: NTIS HC A10/MF A01 CSCL 20/1

This bibliography contains citations of studies and analyses covering a wide range of the parameter of sonic boom and noise pollution, as well as damages caused by it. Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided. Author (GRA)

N77-31671# Energy Research and Development Administration, Pittsburgh, Pa. Energy Research Center.
CHEMICAL CHARACTERIZATION OF DIESEL EXHAUST PARTICULATES
M. Mentser and A. G. Sharkey, Jr. Mar. 1977 53 p refs
(PERC/RI-77/5) Avail: NTIS HC A04/MF A01

High resolution mass spectrometry was used to analyze the organic material associated with diesel exhaust particulates in order to detect hazardous compounds. Diesel fuels and respirable coal mine dusts were also surveyed. Mass spectra were obtained on approximately 50 samples of particulates from diesel engine tests. The tests involved precombustion chamber and direct injection engines operating in different modes of speed and load using three grades of diesel fuel. Distribution of hydrocarbons changed in a characteristic manner as the speed and loading of the engines increased from idle to rated speed and full load. The composition profiles were little affected by engine or fuel type. The composition of diesel particulates was investigated as a function of particle size from less than 0.2 to greater than or approximately equal to 3.0 micrometers. ERA

N77-31672# California Univ., Davis. Radiobiology Lab.
HEALTH EFFECTS OF POLLUTANTS ASSOCIATED WITH FOSSIL-FUEL POWER GENERATION: AN INDEXED BIBLIOGRAPHY WITH ABSTRACTS
J. Azevedo, K. Berding, and S. A. Book Apr. 1976 189 p
(Contract E(04-3)-0472)
(UCD-472-500) Avail: NTIS HC A09/MF A01

Approximately 900 references are contained in this bibliography prepared as part of a risk assessment program. Health hazards associated with pollutants generated from fossil fuel combustion for electrical power production are evaluated. The articles listed comprise the first major section of a continuing literature review. ERA

N77-31673# Center for Energy and Environment Research, Caparra Heights (Puerto Rico).
ECOLOGICAL REVIEW OF HYDROELECTRIC RESERVOIRS IN PUERTO RICO
William R. Jobin, Frederick F. Ferguson, and Raymond Brown Oct. 1976 84 p refs Sponsored by ERDA
(CEER-1) Avail: NTIS HC A05/MF A01

Published literature and available data on the ecology of hydroelectric reservoirs and other lakes in Puerto Rico was reviewed. Various studies on unrelated elements in the aquatic ecology were examined. The majority of the island wide studies pertained to surveys on snails related to the parasitic disease bilharzia. A survey of 28 major lakes in 1976 showed that Biomphalaria glabrata was gradually displaced from most of the lakes by Marisa cornuarietis and Tarebia granifera, two foreign snails which do not transmit bilharzia. Of the 17 lakes containing B. Glabrata in 1956, only 8 remained infested in 1966 and only 5 in 1976, twenty years after the introduction of Marisa cornuarietis. Although the trend indicates that the lakes may be safe from transmission, a monitoring system is necessary before the lakes are used for recreation. Author

N77-31674# Battelle Pacific Northwest Labs., Richland, Wash.
PACIFIC NORTHWEST REGIONAL ASSESSMENT PROGRAM Annual Report, 1975
Jun. 1976 40 p refs
(Contract E(45-1)-1830)
(BNWL-2084) Avail: NTIS

An integrated analytical assessment program was established for evaluation of potential changes that may result from various energy development or conservation scenarios. Such scenarios may themselves result from Federal development policies and programs, from regionally specific actions by the states and energy industries, or from actions taken by international factors currently importing energy resources into the region. After consideration of a variety of approaches to integrated assessment at a regional level, dynamic simulation techniques were developed to provide the best available approach to evaluating the issues pertinent to the Northwest. ERA

N77-31675# Battelle Pacific Northwest Labs., Richland, Wash.
CHARACTERIZATION OF SUBSTANCES IN PRODUCTS EFFLUENTS AND WASTES FROM SYNTHETIC FUEL PRODUCTION TESTS Quarterly Progress Report
M. R. Petersen, J. S. Fruchter, and J. C. Laul Sep. 1976 27 p
(Contract EY-76-C-06-1830)
(BNWL-2131) Avail: NTIS HC A03/MF A02

An up-to-date information on the status of these characterization efforts, both to those concerned with techniques and abatement process development and to the biological and environmental scientists working in this area, is presented. ERA

N77-31676# Pennsylvania Univ., Philadelphia. Dept. of Regional Science.
REGIONAL ECONOMIC IMPACTS OF NUCLEAR POWER PLANTS
Walter Isard, T. Reiner, R. Vanzele, and J. Stratham Aug. 1976 151 p refs
(Contract EY-76-C-02-0016)
(BNL-50562) Avail: NTIS HC A08/MF A01

The economic and social impacts of nuclear power facilities are compared in the Maryland, New Jersey, and Pennsylvania area. I.M.

N77-31677# Missouri Univ., Rolla. Dept. of Chemistry.
IODINE-129: A STUDY OF ITS TRANSPORT IN THE ENVIRONMENT AND DISTRIBUTION IN BIOLOGICAL SYSTEMS Progress Report, 1 Jun. 1976 - 31 May 1977
Oliver K. Manuel Feb. 1977 47 p refs
(Contract EY-76-S-02-2450)
(COO-2450-5) Avail: NTIS HC A03/MF A01

The transport and distribution of I-129 1 in the local environment, was studied with emphases on development of rapid and reliable sampling methods for the routine recovery of iodine from precipitation, surface waters, vegetation and aerosols. Periodic recovery and analysis of iodine in milk, thyroids, surface waters and precipitation, and resolution of discrepancies between interlaboratory standard monitors and the standard I-129 solution prepared and distributed by the National Bureau of Standards (NBS SRM 4949) were also examined. ERA

N77-31678# European Space Agency, Paris (France).
DISPERSION OF TRACE CONSTITUENTS IN THE STRATOSPHERE
Anne-Marie Bouchardy Jul. 1977 143 p refs Transl. into ENGLISH of 'Dispersion dans la Stratosphere de Constituants en Traces', ONERA, Paris Report ONERA-P-1976-7, Jan. 1977 Original report in FRENCH previously announced as N77-25714
(ESA-TT-381; ONERA-P-1976-7) Avail: NTIS HC A07/MF A01

The experimental method consists in creating artificial clouds within the stratosphere, and in observing their evolution from the ground. The observation means used are either a lidar and a still camera, or two ballistic chambers and two still cameras. The measurements carried out allow determination of cloud motion and cloud sizes, during an average of 600 sec. A numerical model was realized, which makes it possible to simulate the evolution of these clouds, and to emphasize the influence of turbulent mixing and wind shear. With this model and experimental results the horizontal diffusion coefficients and their variations with scale can be determined. The values found are between 0.5 and 11 sq m/s, for a time of 300 sec. Some values of the vertical diffusion coefficient were also measured. The results obtained are discussed. A study of the microstructure of clouds permitted the study of the phenomena at a smaller scale.
Author (ESA)

N77-31679# Army Construction Engineering Research Lab., Champaign, Ill.
COMPUTER-AIDED ENVIRONMENTAL IMPACT ANALYSIS FOR AIR FORCE RESEARCH, DEVELOPMENT, TEST AND EVALUATION ACTIVITIES: USER MANUAL Final Report
Susan E. Thomas Apr. 1977 138 p refs
(AD-A039132; CERL-TR-N-20) Avail: NTIS HC A07/MF A01 CSCL 13/2

The federal government has requested that its agencies incorporate environmental considerations into the planning of new projects and activities. Environmental impact assessments and statements (EIA/EIS) provide a basis for review and analysis of a proposed project's environmental consequences. The Environmental Impact Computer System (EICS), developed by the U.S. Army Construction Engineering Research Lab., helps planners efficiently identify primary and secondary impacts of their proposed projects or activities and suggests way to mitigate these impacts. This manual is designed to help Air Force personnel prepare EIAs and EISs using the EICS. Detailed instructions for accessing the research, development, test, and evaluation functional area of EICS are included as is an input form necessary for obtaining EICS output. The manual discusses in detail procedures necessary for using EICS output for environmental impact assessment and outlines the steps for preparing a proper and complete EIA/EIS. Author (GRA)

N77-31680# Environmental Sciences Research Lab., Research Triangle Park, N.C. Emissions Measurement and Characterization Div.
CHARACTERIZATION OF EXHAUST EMISSIONS FROM A DUAL CATALYST EQUIPPED VEHICLE Technical Report, Jul. 1975 - Jul. 1976
Peter A. Gabele, James N. Braddock, Frank M. Black, Fred D. Stump, and Roy B. Zweidinger Apr. 1977 31 p refs
(PB-266941/4; EPA-600/2-77-068) Avail: NTIS

HC A03/MF A01 CSCL 13F

The characterization of exhaust gas emissions from an automobile equipped with a dual catalyst system was effected. The dual catalyst system was designed to reduce emissions of engine exhaust hydrocarbons, carbon monoxide, and nitrogen oxides. A brief discussion of each method used to sample and analyze nonregulated pollutants is included. Results indicate that: (1) sulfate emissions from the dual catalyst car were comparable to those from production catalyst vehicles equipped with air pumps; (2) hydrocarbon emissions were of low reactivity relative to other vehicles; and (3) nickel emissions were quite high. GRA

N77-31681# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.

REGIONAL AIR POLLUTION STUDY: SULFUR COMPOUNDS AND PARTICULATE Final Report

Fred E. Littman, Robert W. Griscom, and Harry Wang Apr. 1977 55 p refs

(Contract EPA-68-02-1081)

(PB-266960/4; EPA-600/4-77-017) Avail: NTIS HC A04/MF A01 CSCL 14B

A methodology for estimating the amount of sulfur trioxide (SO3) emitted by combustion sources was developed. It is based on SO2/SO3 ratios determined both experimentally and from literature surveys. The most likely value appears to 1.85 percent of the SO2 emissions. On this basis, about 22,000 tons of SO3 are emitted yearly from combustion sources. A fine particle size inventory for the St. Louis area was also developed. The inventory gives a breakdown of particulate emissions in the range of 7 to .01 microns, based on production rates and collection efficiencies for point sources in the St. Louis air quality control region. GRA

N77-31682# Defense Documentation Center, Alexandria, Va.

ENVIRONMENTAL POLLUTION: SANITARY ENGINEERING AND INDUSTRIAL WASTE Report Bibliography, Jan. 1963 - Mar. 1977

Jul. 1977 402 p Supersedes DDC-TAS-71-57-1; DDC-TAS-73-75

(AD-A041950; DDC/BIB-77/09; DDC-TAS-71-57-1; DDC-TAS-73-75) Avail: NTIS HC A18/MF A01 CSCL 13/2

This bibliography contains citations of unclassified and unlimited reports dealing with sanitary and industrial wastes, pollution of oceans, rivers, and estuaries by the disposal of garbage, sewage, and wastes. Various methods of reclamation and treatment of waste are presented from life support and closed ecological systems which may prove beneficial to ongoing research and operations for controlling environmental pollution. Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided. Author (GRA)

N77-31683# Environmental Protection Agency, Washington, D.C. Office of Enforcement.

EPA ENFORCEMENT. A PROGRESS REPORT FOR 1976: AIR, NOISE, WATER, PESTICIDES

Jan. 1977 219 p

(PB-267315/0) Avail: NTIS HC A10/MF A01 CSCL 13B

Enforcement activities carried out directly by the U.S. Environmental Protection Agency are documented. GRA

N77-31684# Environmental Protection Agency, Washington, D.C. Office of Enforcement.

EPA ENFORCEMENT. A PROGRESS REPORT, DECEMBER 1974 TO DECEMBER 1975: AIR, NOISE, PESTICIDES, WATER

1976 228 p

(PB-267314/3) Avail: NTIS HC A11/MF A01 CSCL 13B

The U.S. Environmental Protection Agency's air, noise, pesticides, and water enforcement activities are presented to inform all interested segments of the American public on the problems encountered, and the progress achieved, in enforcing the nations's environmental protection laws. GRA

N77-31685# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.

AUTOMOBILE EMISSION CONTROL. THE DEVELOPMENT STATUS, TRENDS, AND OUTLOOK AS OF DECEMBER 1976

Apr. 1977 650 p refs

(PB-267865/4) Avail: NTIS HC A99/MF A01 CSCL 13B

Significant development trends are highlighted in the following areas: 3-way catalysts; improved fuel metering; electronic controls; non-catalytic emission control technology; vehicle space requirements for emission controls; turbocharging; and diesel engine developments. A review of each manufacturer's emission control development efforts is included. GRA

N77-31686# Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.

NONPOINT SOURCE CONTROL GUIDANCE, CONSTRUCTION ACTIVITIES Final Report

Robert E. Thronson Dec. 1976 122 p refs

(PB-267775/5) Avail: NTIS HC A06/MF A01 CSCL 13B

The basic guidance information included in this nonpoint source control document is principally technical in nature and presented in four main chapters. They include information on the identification and assessment of existing construction nonpoint source problems; analysis and procedures needed for selection of controls; descriptions of individual and systems of Best Management Practices (BMP), with a method for determining their effectiveness; and several methods for predicting potential pollution problems from future construction activities. GRA

N77-31687# Georgia Univ., Athens. Dept. of Food Science.

BIOCHEMICAL TRANSFORMATION AND DETOXIFICATION OF MERCURY IN AQUATIC ENVIRONMENT Final Technical Report, Jul. 1974 - Dec. 1976

M. K. Hamdy Feb. 1977 98 p refs

(Contract DI-14-31-0001-3870)

(PB-267926/4; ERC-0277) Avail: NTIS HC A05/MF A01 CSCL 13B

Mercury-resistant cultures were isolated from sediments and adapted to resist higher levels of Hg(+2). One of these cultures, identified as Enterobacter aerogenes, was able to produce methyl mercury (MM) from HGC12. It appears that the transformation of Hg(+2) to MM is a detoxification process by the bacteria. Mercury not only affected intact bacterial cells but also inhibited their enzymes and many of their metabolites, particularly NADH, the coenzyme moity of LDH and MDH enzymes. Mercury inactivated NADH but this reaction can be reversed by the addition of oxalacetate. GRA

N77-31688# Michigan Univ., Ann Arbor. Research Div.

ATMOSPHERIC INPUTS OF PHOSPORUS TO SOUTHERN LAKE HURON, APRIL-OCTOBER 1975 Final Report

Richard G. Delumyea and Resy L. Petel Apr. 1977 65 p refs

(Grant EPA-R-803086)

(PB-267943/9; EPA-600/3-77-038) Avail: NTIS HC A04/MF A01 CSCL 13B

Of the total input, approximately half is potentially available, and one-fourth is immediately available. Inputs due to wet and dry deposition are roughly equal in magnitude. The major source appears to be agriculture with at least 10% due to combustion sources. A model for particulate deposition was used to determine the deposition velocity of phosphorus containing particles. The value of 0.6 cm/sec is considered applicable to other components whose mean diameter is 1 micrometer. GRA

N77-31689# Southern Research Inst., Birmingham, Ala.

RECENT USSR LITERATURE ON CONTROL OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES Final Report, Jan. - Dec. 1976

Charles E. Feazel Apr. 1977 100 p refs Sponsored in part by TVA

(Grant EPA-R-802938)

(PB-268008/0; PRS-24; EPA-600/2-77-084; TVA-PRS-24) Avail: NTIS HC A05/MF A01 CSCL 07A

Approximately 600 articles, published between 1970 and 1975 in several technical and scientific journals in the USSR and compiled and classified according to subject content are reviewed. The articles were selected as significant indicators of the status of the technology of controlling air pollution by particulate emissions from stationary sources, with emphasis on fly ash from the combustion of coal in electric power plants. Control devices include electrostatic precipitators, wet scrubbers, fabric filters, cyclones, and granular bed filters. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N77-31690 Princeton Univ., N. J.
OBSERVATIONS OF LONG PERIOD SURFACE WAVE MULTIPATHING AT THE HIGH-GAIN LONG-PERIOD SEISMOGRAPH STATIONS Ph.D. Thesis
Stuart Kirkland Wier 1977 184 p
Avail: Univ. Microfilms Order No. 77-9990

Data from the high gain long period seismograph stations were studied. Love and Rayleigh surface waves containing components of more than 300 seconds per period were observed. These data were analyzed to verify regional surface wave dispersion determined from great circle analyses, and the differences in earth structure between oceans and continents at depths below 400 km. Surface waves were analyzed using the multiple filter technique, and phase velocities of surface waves traveling between two stations over a purely oceanic or continental path were determined. Phase velocities calculated had unreasonable values compared to known ranges of surface wave phase velocity. Distortions of phase spectra due to interference, and to poor control of the system phase response are the cause of irregular phase velocities. Dissert. Abstr.

N77-31691 Texas Univ., Dallas.
ELECTRICAL CONDUCTIVITY IN THE CRUST OF THE WESTERN UNITED STATES INFERRED FROM CONTROLLED SOURCE ELECTROMAGNETIC DEEP SOUNDING DATA Ph.D. Thesis
Barry Ronald Lienert 1976 206 p
Avail: Univ. Microfilms Order No. 77-9794

Linear inversion techniques were used to infer crustal conductivites from deep data obtained by deep magnetic soundings in the region immediately north of Walker Lake, Nevada, and along the eastern flank of the Sierra Nevada Batholith. The magnetostratigraphy of the lower Triassic Moenkopi formation at Bears Ears, Utah was also studied. Dissert. Abstr.

N77-31692 State Univ. of New York, Stony Brook.
EFFECT OF AEROSOLS ON RADIATIVE TRANSFER IN THE EARTH'S ATMOSPHERE Ph.D. Thesis
Harshvardhan 1976 142 p
Avail: Univ. Microfilms Order No. 77-10740

Possible climatic effects of stratospheric aerosols were studied. An increase in the earth's statospheric aerosol loading could modify global climate by increasing the reflection of sunlight and enhancing the atmospheric greenhouse effect. The impact of wind blown dust particles on the local climate of arid regions was also investigated. Normally the residence time of tropospheric particles is too short to influence the regional climate but situations exist in which dense layers of dust persist for months. In order to examine the effect of this dust layer on the infrared radiative flux and cooling rates, a method is presented for calculating the flux in a dusty atmosphere in the limit of small scattering. Dissert. Abstr.

N77-31693*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A MEASUREMENT SYSTEM FOR THE ATMOSPHERIC TRACE GASES CH4 AND CO Interim Report
Estelle P. Condon Aug. 1977 23 p refs
(Grant NsG-1394)
(NASA-CR-154984; PGSTR-AP77-61) Avail: NTIS HC A02/MF A01 CSCL 04A

A system for measuring ambient clean air levels of the atmospheric trace gases methane and carbon monoxide is described. The analytical method consists of a gas chromatographic technique that incorporates sample preconcentration with catalytic conversion of CO to CH4 and subsequent flame ionization detection of these gases. The system has sufficient sensitivity and repeatability to make the precise measurements required to establish concentration profiles for CO and CH4 in the planetary boundary layer. A discussion of the bottle sampling program being conducted to obtain the samples for the concentration profiles is also presented. Author

N77-31694*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHLOROFLUOROMETHANES AND THE STRATOSPHERE
Robert D. Hudson, ed. Aug. 1977 268 p refs Workshop held at Warrenton, Va., 10 Jan. 1977
(NASA-RP-1010; G-7725) Avail: NTIS HC A12/MF A01 CSCL 04A

The conclusions of a workshop held by the National Aeronautics and Space Administration to assess the current knowledge of the impact of chlorofluoromethane release in the troposphere on stratospheric ozone concentrations. The following topics are discussed; (1) Laboratory measurements; (2) Ozone measurements and trends; (3) Minor species and aerosol measurements; (4) One dimensional modeling; and (5) Muldimensional modeling. For individual titles, see N77-31695 through N77-31699.

N77-31695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LABORATORY MEASUREMENTS
In its Chlorofluoromethanes and the Stratosphere Aug. 1977 p 1-50 refs (For primary document see N77-31694 22-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

A compilation of chemical and photochemical data that are relevant to stratospheric modeling is presented. There are three broad categories of data: (1) rate constants for chemical reactions, including temperature and pressure dependencies along with product distributions; (2) absorption cross sections, photodissociation quantum yield, and photolysis; (3) heterogeneous chemical processes. Author

N77-31696*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASUREMENTS AND ANALYSIS OF OZONE VARIATIONS
In its Chlorofluoromethanes and the Stratosphere Aug. 1977 p 51-88 (For primary document see N77-31694 22-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

The techniques that were used for total ozone and vertical distribution including measurement accuracy and precision are briefly discussed. A description of data availability is provided, and sample total ozone and stratospheric data are presented to illustrate the trends that were deduced from the data. Author

N77-31697*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MINOR SPECIES AND AEROSOLS
In its Chlorofluoromethanes and the Stratosphere Aug. 1977 p 89-131 refs (For primary document see N77-31694 22-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

A variety of species were measured to tie together the efforts of one dimensional and multidimensional models. The existence of critical species in the stratosphere was established. An attempt was made to establish some order to the measurements that were made and the type of problems that exist. Author

N77-31698*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ONE-DIMENSIONAL MODELS
In its Chlorofluoromethanes and the Stratosphere Aug. 1977 p 133-195 refs (For primary document see N77-31694 22-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

The current status of predictions by one dimensional models is reported. The following items are discussed: (1) model mechanics; (2) the parametric simulation of vertical transport, the effects of diurnally varying reactants; and (3) molecular multiple scattering. Possible sinks for chlorofluoromethanes is discussed as well as the uncertanties involved on making predictions of stratospheric ozone change. Author

N77-31699*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTIDIMENSIONAL CFM-O3 MODELING
In its Chlorofluoromethanes and the Stratosphere Aug. 1977 p 197-229 refs (For primary document see N77-31694 22-46)

HC A12/MF A01 CSCL 04A

Examples of feedback among radiative, chemical and dynamical processes are discussed. The characteristics of the two dimensional (2-D) and three dimensional (3-D) models used in stratospheric ozone studies are discussed. The status of these multidimensional atmospheric photochemical models, their current capabilities and limitations, and possible impact on the chlorofluoromethane problem are presented. Requirements, techniques and problems of the parameterization of transport in 3-D models are described, the observational needs of multidimensional models are presented, and a summary is provided. Author

N77-31700*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A MODEL FOR SIMULATING RANDOM ATMOSPHERES AS A FUNCTION OF LATITUDE, SEASON, AND TIME

Janet W. Campbell Washington Sep. 1977 91 p refs
(NASA-TN-D-8470; L-11308) Avail: NTIS HC A05/MF A01 CSCL 04A

An empirical stochastic computer model was developed with the capability of generating random thermodynamic profiles of the atmosphere below an altitude of 99 km which are characteristic of any given season, latitude, and time of day. Samples of temperature, density, and pressure profiles generated by the model are statistically similar to measured profiles in a data base of over 6000 rocket and high-altitude atmospheric soundings; that is, means and standard deviations of modeled profiles and their vertical gradients are in close agreement with data. Model-generated samples can be used for Monte Carlo simulations of aircraft or spacecraft trajectories to predict or account for the effects on a vehicle's performance of atmospheric variability. Other potential uses for the model are in simulating pollutant dispersion patterns, variations in sound propagation, and other phenomena which are dependent on atmospheric properties, and in developing data-reduction software for satellite monitoring systems. Author

N77-31701# Teledyne Geotechnical, Alexandria, Va.

SEISMIC DATA ANALYSIS CENTER Final Technical Report

Royal A. Hartenberger 1 Nov. 1976 55 p
(Contract F08606-76-C-0004; ARPA Order 1620)
(AD-A040301; SDAC-TR-76-13) Avail: NTIS HC A04/MF A01 CSCL 08/11

The Alexandria Laboratories Division of Teledyne Geotech operated the Seismic Data Analysis Center (SDAC) during the fifteen (15) month period beginning 1 July 1975 and ending 30 September 1976. The objectives of the work were: (1) to operate, program, and maintain real-time and batch processors; (2) to provide services to other government agencies and VELA participants; (3) to conduct research in seismology; and (4) to develop systems to control and process seismic inforamtion generated by remote stations in the Expanded VELA Seismic Network. Scientists completed 18 technical reports, 10 technical memoranda and two special reports on various subjects in seismology. The more important scientific results produced by these studies are: the determination that the Norwegian Seismic Array contains many redundant sensors; the conclusion that the difference between magnitude based on S waves and magnitude based on Rayleigh waves is a discriminant between worldwide earthquakes and underground explosions at NTS and Amchitka; the confirmation that the Ms versus mb source discriminant fails for certain earthquakes in Tibet; the observation that both simple and complex earthquakes originate within small areas on the Kamchatka Peninsula; the hypothesis that differences in attenuation account for the differences in teleseismic event magnitude observed in the western and eastern United States and a study which supports the hypothesis using data from several underground nuclear explosions. In the area of network development, a new software system was installed which detects amplitudes above a prescribed level on seismograms recorded by the VELA network. GRA

N77-31702# Naval Research Lab., Washington, D. C.

INTEREACTION BETWEEN STEADY NON-UNIFORM TWO-DIMENSIONAL CURRENTS AND DIRECTIONAL WIND-GENERATED GRAVITY WAVES WITH APPLICATIONS FOR CURRENT MEASUREMENTS Final Report

Davidson T. Chew and Paul Bey May 1977 34 p refs
(AD-A040600; NRL-MR-3508) Avail: NTIS HC A03/MF A01 CSCL 20/4

Interactions between steady non-uniform two-dimensional currents and directional gravity waves are studied for the case of a random wave field which is actively generated by the wind. Directional wave number spectrum in the form suggested by Phillips, Kitaigorodskii, Pierson-Moskowitz, and Longuet-Higgins-Cartwright-Smith is used as the basic spectral form for zero current conditions. Modified spectral functions under the influence of current are found by solving the kinematic wave conservation equation and the energy balance equation with the method of characteristics. By using this particular method, one can solve the problems of two-dimensional wave-current interactions by either specifying U and wave energy, E, or specifying wave number vector, k, and E, for every point space, x. The remote sensing techniques are suggested to be the best and the most convenient feasible way of measuring these parameters for inferring the current field. Thus the changes in wave characteristics, in the form of directional wave spectra, can readily be numerically calculated as the directional wind-generated gravity waves encounter the steady non-uniform two-dimensional currents. Using the remote sensing techniques which are capable of observing these changes in waves over a large area, one will be able to infer the magnitude and the direction of the current encountered. This particular method of inferring current field has great potential benefits in global applications. GRA

N77-31703# Texas Instruments, Inc., Dallas. Equipment Group.

VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH. A TIME VARIANT WIENER FILTER FOR DISPERSED WAVEFORMS

Rudolph Unger 29 Oct. 1976 115 p refs
(Contract F08606-76-C-0011; ARPA Order 2551; Proj. VELA-UNIFORM)
(AD-A041006; TI-ALEX(01)-TR-76-08) Avail: NTIS HC A06/MF A01 CSCL 20/14

A time-variant Wiener filter based on the regionally dispersive characteristics of long-period surface waves is presented. The dispersion curves are determined with maximum entropy spectral analysis. The filter performance is tested with synthetic chirp waveforms and with real seismic data. The filter enhances the estimation of signals and, in particular, the surface wave magnitude measurability, for waveforms with signal-to-noise ratios down to dB RMS. For lower signal-to-noise ratios the signal estimates are less reliable, and magnitude estimates may be biased. Compared with bandpass filtering, noise rejection improvement ranges from 3 to 9 dB. The filter's ability to separate multiple signals is limited by filter impulse response side lobe interference. The filter performance is furthermore limited by dispersion of noise, by non-stationary noise, by the filter's inherent ability to generate false signals from broadband noise components, by the signaal bandwidth, by the regional dispersion curve variation, by narrowband filter response characteristics, and by the reliability and resolution of state-of-the-art spectral analysis methods. GRA

N77-31704# Army Electronics Command, Fort Monmouth, N.J.

STRATOSPHERIC OZONE DENSITY AS MEASURED BY A CHEMILUMINESCENT SENSOR DURING THE STRATCOM 6-A FLIGHT

Jagir S. Randhawa, M. Izquierdo, Carlos McDonald, and Zui Salpeter Apr. 1977 28 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A040663; ECOM-5816) Avail: NTIS HC A03/MF A01 CSCL 04/1

Ozone concentration was measured by the chemiluminescent technique during the STRATCOM VI-A balloon flight flown from Holloman Air Force Base, New Mexico, on 23 September 1975. More than 30 hours of data were collected as the balloon floated at various altitudes in the stratosphere. A diurnal variation in ozone above the ozone peak was observed in the 27 to 40 km region. Wet stratospheric photochemistry is used as a guide to explain the diurnal change in ozone. Author (GRA)

N77-31705# Aeronutronic Ford Corp., Billings, Mont. Engineering Services Div.

MONTANA LARGE APERTURE SEISMIC ARRAY Semiannual Technical Report, 1 Oct. 1976 - 31 Mar. 1977
Robert E. Matkins 26 Apr. 1977 58 p refs
(Contract F08606-77-C-0009)
(AD-A041037; TR-2140-77-92) Avail: NTIS HC A04/MF A01 CSCL 17/10

The continued operation, maintenance, and array improvement activities at the Montana LASA during the period between October 1, 1976, and March 31, 1977, are described. Array operations are detailed. Progress in seismic event processing is reported. Seismograph measurements, IBM 360 computer reliability and maintainability statistics, and PDP-7 computer programs are presented. Maintenance activities at the data and maintenance centers are discussed. Author (GRA)

N77-31706# Air Force Geophysics Lab., Hanscom AFB, Mass.
A MODEL FOR THE ELECTRICAL CURRENT COLLECTED PLANAR APERTURE ION COLLECTOR WITH A PARTIALLY BLOCKED FIELD OF VIEW Environmental Research Papers
Frederick Rich and Peter J. L. Wildman 25 Apr. 1977 21 p refs
(AD-A040919; AFGL-TR-77-0096; AFGL-ERP-595) Avail: NTIS HC A02/MF A01 CSCL 04/1

Models of the electrical current collected by a planar aperture ion sensor generally assume that the 2 pi steradian field of view is unobstructed. This is not always achieved. This report shows the development of a model for the measured current based on a simple approximation for the obstructions that are placed in the field of view of any planar aperture ion sensor. The details of the model given herein are related to the ion sensors onboard two Air Force satellites, where the sensors have been recessed below the level of the spacecraft skin. However, the model can easily be adapted to many other cases of obstructions in the field of view. For collection of data when the ambient ion thermal speed is negligible compared to the relative bulk flow (ram) speed, the obstructions are only important when the flow vector from the ambient plasma to the plasma sensor intersects the obstructions. For the collection of data when the ion thermal speed is comparable to the relative bulk flow speed, the obstructions affect the amount of current collected by the sensors at all orientations of the spacecraft to the bulk flow direction. Author (GRA)

N77-31707# Air Force Geophysics Lab., Hanscom AFB, Mass.
MIDLATITUDE TOTAL ELECTRON CONTENT AND SLAB THICKNESS: A SUMMARY OF SEASONAL, SOLAR CYCLE, AND MAGNETICALLY DISTURBED BEHAVIOR Environmental Research Papers
J. A. Klobuchar 10 Mar. 1977 23 p refs
(AD-A040916; AFGL-TR-77-0065; AFGL-ERP-593) Avail: NTIS HC A02/MF A01 CSCL 04/1

This paper is a summary of the results of nearly a full solar cycle of recordings of Total Electron Content, TEC, taken from Hamilton, Massachusetts, a northern midlatitude station. While many of the aspects of TEC behavior from this station have been published separately, the completion of a nearly full solar cycle of data recordings provides a convenient time to compile a summary of the conclusions drawn from this work. The major features of diurnal, seasonal, and solar-cycle dependence of TEC and equivalent slab thickness are described. The seasonal anomaly in daily maximum TEC has a pronounced peak during equinoxes, as does N(max) from a nearby ionosonde. Daytime equivalent slab thickness, however, has no seasonal anomaly and a negligible semiannual component. Slab thickness is also shown not to be a useful measure of daytime neutral temperature. Average changes in TEC, N(max) and slab thickness during magnetic storms are summarized as well. Author (GRA)

N77-31708# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATMOSPHERIC TRANSMITTANCE FROM 0.25 TO 28.5 MICROMETERS: SUPPLEMENT LOWTRAN 3B (1976)
J. E. A. Selby, E. P. Shettle, and R. A. McClatchey 1 Nov. 1976 77 p refs
(AF Proj. 7670)
(AD-A040701; AFGL-TR-76-0258; AFGL-ERP-587) Avail: NTIS HC A05/MF A01 CSCL 04/1

This supplement provides several additions and updates to the LOWTRAN 3 computer code, which can be used to calculate the transmittance of the atmosphere from the ultraviolet to the middle infrared portion of the spectrum (0.25 to 28.5 micrometers) at a spectral resolution of 20 cm. The major additions are the inclusion of water vapor continuum attenuation in the 3.5 to 4.2 micrometers region, and a temperature dependence to the H2O continuum attenuation coefficient in both the 4 micrometers and 10 micrometers regions. The contribution of foreign gas broadening in the 8-14 micrometers region has also been reduced. Four aerosol models are included in this supplement. These include three boundary layer aerosol models for maritime, urban, and rural conditions in the lower 2 km of the atmosphere, and a tropospheric model for use mainly above 1 or 2 km altitude. The rural model is a replacement for the average continental model presently in LOWTRAN 3. A temporary provision is also given to accommodate fog conditions when the visual range falls below 2 km. Author (GRA)

N77-31709# Utah State Univ., Logan. Electro-Dynamics Lab.
COMPUTER-AIDED ESTIMATES OF THE ROTATIONAL TEMPERATURE OF O2 IN THE MESOSPHERE
Shou-Chi Sue and Doran J. Baker Jul. 1976 79 p refs Sponsored in part by DNA
(Contract F19628-73-C-0048)
(AD-A040915; AFGL-TR-76-0212; Scientific-5) Avail: NTIS HC A05/MF A01 CSCL 07/4

Measurements have been made of the apparent rotational temperature of O2 (b(1)Sigma(g-)) atmospheric (0,1) band emissions. The data were taken at nighttime in the auroral zone at Poker Flat, Alaska, on March 1, 1975. The average apparent temperature was 210 k and the zenith radiance of the band was 500 R (uncorrected for atmospheric extinction). A comparison technique was developed to compare the band shape of the measured band with theoretical spectra synthesized at different, but specific, rotational temperatures. Three methods of comparison were used and it was concluded that a sum of squares weighting approach is near optimal for estimating rotational temperatures. The effect of noise was tested by adding real typical noise to the synthetic model. The same comparison technique was then applied to assess the benefits of noise. The uncertainty of the measurement is estimated to be 5 K. A 'wavelike' fluctuation of the apparent rotational temperature, with a period on the order of 1/2 to 1 hour, was observed. The fluctuation on this occasion appeared to covary with the intensity of the OH airglow emission. GRA

N77-31710# Army Electronics Command, Fort Monmouth, N.J.
MEASUREMENTS OF NET ATMOSPHERIC IRRADIANCE IN THE 0.7- TO 2.8- MICROMETER INFRARED REGION
Roberto Rubio and Mike Izquierdo May 1977 26 p
(DA Proj. 1L1-61102-D-53A)
(AD-A041076; ECOM-5817) Avail: NTIS HC A03/MF A01 CSCL 04/1

The objective of this experiment was to measure atmospheric irradiance within the 0.7- to 2.8-micrometer infrared wavelength region from a balloon platform at altitudes ranging from 5 to 39 kilometers. An Epply precision spectral pyranometer pointed in a general downward direction and equipped with a 7-degree field of view field stop was successfully employed to collect irradiance data for a period of 34 hours on 23, 24, and 25 September 1976. The results showed that at low solar zenith angles and in the absence of clouds the atmospheric irradiance values usually remained within 2.2 x 1/100 cal/sq cm min and 2.6 x 1/100 cal/sq cm min. Clouds attenuated the irradiance down to magnitudes below 4 x 1/10,000 cal/sq cm min which was the combined noise level of the pyranometer and associated electronics. At high solar zenith angles, specular reflections of sunlight which entered the pyranometer's field view caused enhancements of the measured irradiance to reach magnitudes greater than the instrument could measure (3.5 x 1/100 cal/sq cm min). No significant variations in irradiance were detected with changes in altitude above 5 kilometers or terrain viewed; therefore, the background intensity is attributed to the radiant emittance of the lower atmosphere. GRA

N77-31711# Colorado School of Mines, Golden. Office of Research Services.

RESEARCH ON THE USE OF INDUCED POLARIZATION MEASUREMENTS TO STUDY THE MECHANICAL PROPERTIES OF UNCONSOLIDATED MATERIALS Final Report, 1 Oct. 1975 - 30 Sep. 1976

George V. Keller 24 May 1977 21 p refs
(Contract F19628-76-C-0088)
(AD-A041903; AFGL-TR-77-0050) Avail: NTIS HC A02/MF A01 CSCL 08/13

It has been suggested by previous investigators that measurements of induced polarization made on clay-bearing materials can be used to determine the permeability to fluids or the mechanical properties of those materials. A laboratory and field study was undertaken to determine the reliability with which induced polarization surveys could be used in engineering applications. Careful laboratory measurements made on mixtures of clay and sand indicated that the level of induced polarization was very low. Equipment with a precision exceeding that currently available for use in making induced polarization field surveys would be required to detect the effect. Because the sponsoring agency had no further interest in developing a method based on such sensitive measurements, field studies were not undertaken. Author (GRA)

N77-31712# Kanner (Leo) Associates, Redwood City, Calif.

MAGNETIC MEASUREMENTS AND VOLCANIC ACTIVITY: SOUFRIERE 1976

F. Robach, M. Bof, and G. Rey-Giraud Jan. 1977 20 p refs Transl. into ENGLISH from FRENCH CEA Note
(LA-TR-77-8; CEA-Note-LETI/MA-76-952-FR/AL) Avail: NTIS HC A02/MF A01

A study of Soufriere, a volcano on Guadeloupe, by magnetic measurements showed that the volcanic manifestations and the effects measured by high sensitivity differential magnetometry are correlated. The correlation is quite sharp, and even such weak manifestations as ash emissions are perceived. The most natural interpretation of the observations is based on piezomagnetism. The principle itself of phreatic manifestations, the dynamics of the phenomenon, observed ground deformations and the order of magnitude of the effect are favorable in this sense. ERA

N77-31713# Tuebingen Univ. (West Germany). Astronomisches Inst.

STUDIES OF HORIZONTAL ELECTRIC FIELDS IN THE TROPOSPHERE AS A FUNCTION OF METEOROLOGICAL, OROGRAPHICAL AND ANTHROPOGENIC INFLUENCES, TO DETERMINE STATIC ELECTRICITY CONDITIONS FOR USING ELECTROSTATIC AUTOPILOTS Final Report [UNTERSUCHUNGEN HORIZONTALER ELEKTRISCHER FELDER IN DER TROPOSPHAERE IN ABHAENGINGKEIT METEOROLOGISCHER, OROGRAPHISCHER UND ANTHROPOGENER EINFLUESSE IM HINBLICK AUF DIE LUFTELEKTRISCHEN VORAUSSETZUNGEN FUER EINSATZ ELEKTROSTATISCHER AUTOPILOTEN]

R. Muehleisen and Heinz-Juergen Fischer Mar. 1977 14 p refs In GERMAN Sponsored by Bundesmin. fuer Forsch. u. Technol.
Avail: NTIS HC A02/MF A01

The magnitude and inclination of the atmospheric electric field vector, as well as the value of its horizontal component, were determined in the free atmosphere using measuring instruments installed in a powered glider; 20 test flights were carried out amounting to a measurement time of 24 hours. The situation above flat and mountainous terrain and above areas with no, low, and high industrial concentration was investigated at flight altitudes between 50 and 3000 m. The meteorological conditions were limited to good weather and light rainfall. Results of flight measurements are reported: ESA

N77-31714# Lowell Univ., Mass. Center for Atmospheric Research.

GEOMONITOR: DIGITAL REAL TIME PROCESSOR FOR GEOPHYSICAL DATA Final Report, 1 Jan. - 30 Sep. 1976

Bodo W. Reinisch and Sheryl Smith Dec. 1976 38 p refs
(Contract F19628-76-C-0163)
(AD-A040036; AFGL-TR-76-0292) Avail: NTIS HC A03/MF A01 CSCL 04/1

The geomonitor was developed to process in real time digital ionograms from the Digisonde 128 and to digitize, format and record 15 geophysical observables: three components of the geomagnetic field, two riometer channels, two scintillation channels (amplitudes from two beacon satellites signals), two polarimeter channels (quadrature phases from one satellite signal), plus six other variables. The processed data are stored on magnetic tape, displayed on a plasma display and printed on one electrostatic and five mechanical printers. The ionogram processing extracts and retains only the most significant echo information for each transmitted frequency: amplitude and virtual height of up to six echoes, echo spread, background noise and receiver gain. A built-in algorithm permits one to reconstitute ionograms from the collated data and display them on the plasma display to verify proper operation of the geomonitor. Mechanical printers present the ionospheric characteristics: ftE, ftF, h:min for vertical and backscatter ionograms. The geomonitor is operating at the AFGL Goose Bay Ionospheric Observatory. Author (GRA)

N77-31715# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

ROCK, FROZEN SOIL AND ICE BREAKAGE BY HIGH-FREQUENCY ELECTROMAGNETIC RADIATION. A REVIEW

Pieter Hoekstra Oct. 1976 23 p
(AD-A039178; CRREL-76-36) Avail: NTIS HC A02/MF A01 CSCL 08/7

In the past decade, various workers have investigated the use of high-frequency electromagnetic radiation for breaking and excavating rock and frozen ground. This report reviews the high-frequency dielectric properties of these materials, the physics of heating, and the existing literature on these subjects. The high-frequency dielectric properties of rocks and soils, and the absorption of energy by these materials, are mainly determined by their liquid water contents. Computer modeling was used to calculate absorption energy as a function of distance behind irradiated faces of earth materials. The resulting computations showed that most energy is absorbed in the first few centimeters of frozen ground and weak soils. However, in hard rocks of low water content, electromagnetic waves penetrate more deeply, and significant amounts of energy are also absorbed tens of centimeters behind the irradiated faces. Test results showed that electromagnetic rock breakage is feasible only for excavations in hard rock; test results from the use of electromagnetic radiation for excavating tunnels in weak rocks and frozen ground are not promising. Author (GRA)

N77-31716# Rome Air Development Center, Griffiss AFB, N.Y.

VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE Technical Report, 1 Jan. - 3 Jul. 1976

John E. Rasmussen, John P. Turtle, Robert P. K. Pagliarulo, and Wayne I. Lemetti Feb. 1977 119 p
(AD-A040920; RADC-TR-77-68) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary information. Author (GRA)

N77-31717# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Lab.

LONGITUDE-TIME PATTERN FOR QUIET-TIME MIDLATITUDE ELECTRON PRECIPITATION Interim Report

Janet G. Luhmann and Alfred L. Vampola 10 May 1977 33 p refs
(Contract F04701-76-C-0077)
(AD-A040470; TR-0077(2260-20)-7; SAMSO-TR-77-97) Avail: NTIS HC A03/MF A01 CSCL 04/1

During geomagnetically quiet times, particle precipitation at midlatitudes ($2 < \text{or} = L < \text{or} = 4$) results from a combination of pitch angle diffusion into the bounce loss cone and the opening of the bounce loss cone in the direction of drift to a maximum value which defines the drift loss cone. The geographical distribution of precipitation can thus be determined from geomagnetic field models which give the rate of change of the bounce loss cone size provided that an assumption is made

about the spatial distribution of the source region where particles are scattered in the drift loss cone. Some observations indicate that the pitch angle scattering of kilovolt electrons occurs preferentially in the 0600-1200 LT quadrant of the magnetosphere. If the source of drift loss cone electrons is localized, precipitation into the midlatitude atmosphere will depend on both longitude and time of day. A simple model, in which the morning source is represented by a delta function at 0800 LT, leads to a qualitative picture of the morphology of precipitation in both Northern and Southern Hemispheres. The predictions of this model are consistent with some observations of 29 and 59 keV electrons from the low altitude satellite 1972-76B.
Author (GRA)

N77-31718# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Science Lab.
BOUNDARY LAYER DUST OCCURRENCE, III, ATMOSPHERIC DUST OVER RUSSIA
B. D. Hinds and G. B. Hoidale May 1977 389 p refs
(AD-A040581; ECOM-DR-77-2) Avail: NTIS HC A17/MF A01 CSCL 04/1

This is the third in a series of reports designed to provide a guide to the occurrence of atmospheric dust over selected geographical areas. Tabularized data on the diurnal variation of occurrence by month and on the duration factor for selected time periods throughout a year for blowing dust (visibility less than 11 km) and of dust storms (visibility less than 1 km) are presented for 85 stations in Siberia, 75 stations in Soviet Central Asia, and 54 stations in the Union of Soviet Socialist Republics. Previously published climatological data on the occurrence of dust over the three geographical subdivisions are summarized in Appendix A. Where translations of these articles into English are known to exist, they are included in Appendix B.
Author (GRA)

N77-31719# Naval Research Lab., Washington, D. C.
TRANSIONOSPHERIC DIFFERENTIAL DELAY MEASUREMENTS USING THE NTS SATELLITES Final Report
Carl J. Morris Apr. 1977 79 p refs
(AD-A040776; NRL-MR-3485) Avail: NTIS HC A05/MF A01 CSCL 04/1

When a signal passes through the ionosphere it experiences a delay proportional to the total electron content TEC of the ionosphere. Variations in the TEC can have a significant effect on the error and power budgets of satellite navigation systems. This report describes the design and construction of equipment to measure and digitally record the transionospheric differential delay of signals from the NTS satellites. Author (GRA)

N77-31720# Air Force Geophysics Lab., Hanscom AFB, Mass.
ROCKET MEASUREMENT OF THE ENERGY DISTRIBUTION AND FLUX OF THERMOSPHERIC PHOTOELECTRONS Environmental Research Papers.
W. J. McMahon and L. Heroux 13 Jan. 1977 30 p refs
(AD-A040777; AFGL-TR-77-0013) Avail: NTIS HC A03/MF A01 CSCL 04/1

An electron analyzer of the 127 deg cylindrical electrostatic deflection type, designed to measure the energy distribution and flux of thermospheric photo-electrons in the energy range from near zero to 100 eV, has been successfully flown on a rocket probe. The design and operational characteristics of the instrument are briefly described and the importance of full calibration procedures discussed. Methods for correcting or minimizing the effects of vehicle-induced disturbance of the environment being measured were incorporated into the experiment. These included correction for the energy attenuation and refractive signal losses which are the dual effects of vehicle skin charge. Photoelectron spectra in the energy range 2 to 100 eV were measured over an altitude range of 100 to 220 km during the first flight of the instrument. GRA

N77-31721# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATLAS OF CLOUD-FREE LINE-OF-SIGHT PROBABILITIES. PART 2: UNION OF SOVIET SOCIALIST REPUBLIC
Iver A. Lund, Donald D. Grantham, and Clarence B. Elam, Jr. 30 Dec. 1976 64 p
(AD-A040705; AFGL-TR-77-0005-Pt-2; AFGL-AFSG-358-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 04/1

This is the second part of a planned Northern Hemisphere atlas of probabilities of cloud-free lines-of-sight between the earth and space. The probabilities are for the mid-season months-January, April, July, and October; four times of the day-0000-0200 LST, 0600-0800 LST, 1200-1400 LST, and 1800-2000 LST; and three elevation angles-10,30, and 90 deg. Author (GRA)

N77-31722# Air Force Geophysics Lab., Hanscom AFB, Mass.
A METHOD FOR DETERMINING THE POINT OF LIFT-OFF AND MODIFIED TRAJECTORY OF A GROUND-BASED HEATED TURBULENT PLANAR JET IN A CO-FLOWING WIND
Milton M. Klein 2 Feb. 1977 23 p refs
(AD-A040704; AFGL-TR-77-0033; AFGL-AFSG-361) Avail: NTIS HC A02/MF A01 CSCL 04/1

Experimental and theoretical programs are being conducted to aid in the development of an operational Warm Fog Dispersal System using ground based heat sources. To help determine optimum heat and thrust combinations for the system, investigations have been made of the buoyant motion of heated turbulent jets in co-flowing; that is, same direction ambient winds. To take account of the ground effect, an analysis has been made of the experimental data for the planar jet at the point of lift-off in terms of the local Froude number at this point. From this correlation a procedure has been developed for determining the lift-off point, using the ambient wind and initial velocity and temperature of the jet as input variables. A new jet trajectory may now be easily calculated with only a simple modification of the original method in which the ground effect was ignored.
GRA

N77-31723# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN EXAMINATION OF THE TEMPERATURE MEASURING ACCURACY OF A FLOWMETER SYSTEM USED WITH BALLOON-BORNE ATMOSPHERIC SAMPLERS Instrumentation Papers
Robert H. Cordella, Jr. 2 Feb. 1977 37 p
(AD-A040702; AFGL-TR-77-0034; AFGL-IP-252) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report examines the temperature accuracy of a flowmeter system in two modes. Each mode is defined by the type of thermistor and its monitoring circuit. Laboratory data and flight data gathered at 15.2 to 27.4 km (50 to 90 k ft) are compared to the calculated error envelope. Agreement between the predicted and actual performance is excellent. Author (GRA)

N77-31724# Texas Univ. at Dallas, Richardson.
AURORAL DATA ANALYSIS
J. David Winningham, Walter J. Heikkila, and Gordon G. Shepherd 15 Feb. 1977 49 p
(Contract F19628-76-C-0005)
(AD-A040934; Scientific-1; AFGL-TR-77-0047) Avail: NTIS HC A03/MF A01 CSCL 04/1

During the previous year four papers have been published in refered journals. In addition one more is accepted for publication and three more are in the refereeing process. Each deals with effects produced by auroral particles on the ionosphere and atmosphere and in turn how the dynamics of auroral particles are influenced by terrestrial and interplanetary magnetic activity. In particular, a framework has been laid that relates the equatorward edge of auroral particle precipitation to the IMF Bz component and substorm activity. Work is at present being carried on that both qualitatively and quantitatively relates the equatorward edge of the trough to the 6300 A optical emission and electron fluxes observed by ISIS 2. Utilizing electron fluxes as the common link, it is hoped that the end result will be an empirical relation between the poleward trough wall and influences that modify its position. Author (GRA)

N77-31725# Montana Dept. of Health and Environmental Sciences, Helena.
ALLUVIAL VALLEY FLOORS IN EAST-CENTRAL MONTANA AND THEIR RELATION TO STRIPPABLE COAL RESERVES. A RECONNAISSANCE REPORT
Jack Schmidt Jan. 1977 148 p refs
(PB-267280/6; EPA-908/4-77-001) Avail: NTIS HC A07/MF A01 CSCL 08I

The chief purpose of the project was the preliminary

assessment of the impact of a prohibition against mining alluvial valley floors on the coal resources of portions of Dawson, Garfield, McCone, and Richland Counties, Montana. A secondary purpose was the assessment of some of the physical and land use characteristics of these areas, and their importance to the local farming and ranching economy. Field work, data compilation, and report preparation were accomplished in less than five months. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-31726+ National Environmental Satellite Service, Washington, D. C.
KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5. 4: ENVIRONMENTAL SATELLITE IMAGERY, FEBRUARY 1977
Sep. 1977 89 p refs
(KMRD-5.4; NOAA-S/T-77-2953) Avail: NTIS HC A05

Daily mosaics are presented for the Northern and Southern Hemispheres. They were prepared from data swaths by a scanning radiometer on the NOAA 2, 3, 4, and 5 satellites. Author

N77-31727*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME BASIC MATHEMATICAL METHODS OF DIFFUSION THEORY
A. C. Giere Jul. 1977 80 p refs
(NASA-TM-78128) Avail: NTIS HC A05/MF A01 CSCL 04B

An introductory treatment of the fundamentals of diffusion theory is presented, starting with molecular diffusion and leading up to the statistical methods of turbulent diffusion. A multilayer diffusion model, designed to permit concentration and dosage calculations downwind of toxic clouds from rocket vehicles, is described. The concepts and equations of diffusion are developed on an elementary level, with emphasis on atmospheric applications. Author

N77-31728*# National Climatic Center, Asheville, N. C.
PROBABILITIES OF GOOD, MARGINAL, AND POOR FLYING CONDITIONS FOR SPACE SHUTTLE FERRY FLIGHTS
Dick M. Whiting and Nathaniel B. Guttman Aug. 1977 34 p ref
(NASA Order H-95560A)
(NASA-CR-150363) Avail: NTIS HC A03/MF A01 CSCL 04B

Empirical probabilities are provided for good, marginal, and poor flying weather for ferrying the Space Shuttle Orbiter from Edwards AFB, California, to Kennedy Space Center, Florida, and from Edwards AFB to Marshall Space Flight Center, Alabama. Results are given by month for each overall route plus segments of each route. The criteria for defining a day as good, marginal, or poor and the method of computing the relative frequencies and conditional probabilities for monthly reference periods are described. Author

N77-31729# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
INFRASOUND FROM CONVECTIVE STORMS. PART 2: A CRITIQUE OF SOURCE CANDIDATES
T. M. Georges Oct. 1976 64 p refs
(NOAA-TR-ERL-380-WPL-49-Pt-2) Avail: NTIS HC A04/MF A01

Several acoustic radiation mechanisms that have been suggested to explain the ultra-low-frequency emissions from certain severe thunderstorms that are observed on the ground and in the ionosphere are examined. The candidates are: (1) simple acoustic sources (monopole, dipole) related to the expansion of heated storm air and to the storm-scale circulation pattern; (2) the random acoustic noise from turbulent motions inside storms; (3) low-frequency thunder, i.e., the radiation from lightning discharges or electrostatic relaxation inside storms; (4) vortex sound, the radiation from several kinds of unsteady vorticity or the interaction of multiple-vortex systems; and (5) thermomechanical oscillations driven by the interaction between latent heat release and the storm's updraft. Each mechanism is evaluated for realism in terms of actual storm processes, and the predicted acoustic power and its spectral content are compared with those required by acoustic measurements. The mechanism most consistent with the observations appears to be a form of vortex radiation, in which instabilities and, ultimately, multiple vortices form about the periphery of a larger, mesoscale vortex, and radiate narrow-band sound as they spin about a common axis. Author

N77-31730# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DISTRIBUTION OF SHEER STRESS IN THE QUASI-NEUTRAL ATMOSPHERIC BOUNDARY LAYER M.S. Thesis [DISTRIBICAO DA TENSAO DE CISALHAMENTO A SUPERFICIE CAMADA LIMITE METEOROLOGIA]
Silvio DeOliveira Jul. 1977 77 p refs In PORTUGUESE; ENGLISH summary
(INPE-1073-TPT/060) Avail: NTIS HC A05/MF A01

An analysis is made of some characteristics of the steady turbulent transfer in the atmospheric surface boundary layer. Quasi-neutral experimental wind profiles are used to study vertical ditribution of shear stress in a stratified boundary layer. Applicability of a power law in representing wind profiles over various aerodynamic surfaces is examined. It is found that the variations in the power law exponent m are due to the distribution of eddy diffusivity coefficient for momentum which depends on the roughness of the surface and the atmospheric stability. The magnitude of m values is in general agreement with those in the literature when lapse rate and surface roughness are taken into account. Vertical distribution of shear stress is analysed and its variation confirmed to be non-linear. The drag coefficient is calculated for various natural surfaces. It is found that it depends on the aerodynamic characteristics of the surface and the reference velocity. Finally, a method is presented to predict shear stress at the surface. The predicted results are shown to compare favorably with the experimental data. This simple method can be adapted to obtain shear stress at the surface in the energy budget studies. Author

N77-31731*# Science Applications, Inc., Huntsville, Ala.
OPTIMUM SPACE SHUTTLE LAUNCH TIMES RELATIVE TO NATURAL ENVIRONMENT Final Report
R. L. King Sep. 1977 383 p
(Contract NAS8-31798)
(NASA-CR-150374) Avail: NTIS HC A17/MF A01 CSCL 04B

Three sets of meteorological criteria were analyzed to determine the probabilities of favorable launch and landing conditions. Probabilities were computed for every 3 hours on a yearly basis using 14 years of weather data. These temporal probability distributions, applicable to the three sets of weather criteria encompassing benign, moderate and severe weather conditions, were computed for both Kennedy Space Center (KSC) and Edwards Air Force Base. In addition, conditional probabilities were computed for unfavorable weather conditions occurring after a delay which may or may not be due to weather conditions. Also, for KSC, the probabilities of favorable landing conditions at various times after favorable launch conditions have prevailed have been computed so that mission probabilities may be more accurately computed for those time periods when persistence strongly correlates weather conditions. Moreover, the probabilities and conditional probabilities of the occurrence of both favorable and unfavorable events for each individual criterion were computed to indicate the significance of each weather element to the overall result. Author

N77-31732# Radiation Research Associates, Inc., Fort Worth, Tex.
SOLAR INFRARED REFLECTION AND INFRARED EMISSION FROM A DUST LOADED CLOUD
M. B. Wells 6 May 1977 31 p refs Presented at the Ann. Satellite Diagnostic Working Group Meeting, Patrick AFB, Fla., 8-10 Feb. 1977 Sponsored by AF
(AD-A039535; RRA-M7701; AFTAC-TR-77-14) Avail: NTIS

HC A03/MF A01 CSCL 17/5

This paper presents the results of Monte Carlo calculations of reflected sunlight and air emission in the 2.653 micrometers to 2.760 micrometers wavelength band for satellite-based detectors viewing a cumulus cloud loaded with various amounts of Sahara dust positioned between 14 and 15 km altitude. The results of the calculations showed that the presence of a dust loading of .00005 cu cm of Sahara dust per m cubic meter of the cloud probably cannot be detected at that wavelength. Increasing the dust loading to the cloud by a factor of 100 or more gave results that indicated that the presence of the dust could be determined by the use of reflected sunlight in the 2.7 micrometers wavelength band. Mie calculations for both the cloud and Sahara dust indicates that the best wavelength for detection of the air emission would be wavelengths near 10 micrometers. Additional calculations are in progress for other wavelengths in the 2 micrometers to 15 micrometers wavelength range. GRA

N77-31733# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

STATISTICAL MODELS OF SUMMER RAIN SHOWERS DERIVED FROM FINE-SCALE RADAR OBSERVATIONS

Thomas G. Konrad Apr. 1977 65 p refs

(Contract N00017-72-C-4401)

(AD-A040988; APL/JHU-CR-056) Avail: NTIS HC A04/MF A01 CSCL 04/1

The fine-scale, three-dimensional structure of summer rain showers in the mid-Atlantic region has been analyzed using data from a high-power, narrowbeam radar coupled with automatic data sampling and recording equipment. Statistical descriptions of the rain cells in terms of a variety of physical cell parameters such as core reflectivity, contour area, and altitude extent have been generated along with the frequency of occurrence for various storm classes and categories. The statistical descriptions of the rain cells were compared with those from previous investigators at other geographical locations. Simplified models of rain cells based on the statistical descriptions are developed for different rain categories as a function of frequency of occurrence.

Author (GRA)

N77-31734# Naval Weapons Center, China Lake, Calif.

PROJECT FOGGY CLOUD 6: DESIGN AND EVALUATION OF WARM-FOG DISPERSAL TECHNIQUES Summary Report, 15 Aug. - 4 Nov. 1973

R. F. Reinking, R. S. Clark, W. G. Finnegan, T. L. Wright, and J. W. Carroz May 1977 110 p refs

(AD-A040980; NWC-TP-5824) Avail: NTIS HC A06/MF A01 CSCL 04/2

The Naval Weapons Center, working in collaboration with various activities listed herein, conducted a series of warm-fog modification experiments under Project Foggy Cloud VI. Eletrostatically-charged droplets dispensed from aircraft to induce fog droplet coalescence and rainout, and electrostatically-charged bubbles dispensed from the surface to collect and precipitate fog droplets were techniques tested at the Arcata-Eureka Airport in northern California. The spreading and maintenance of monomolecular films on the water surface to suppress evaporation and inhibit fog formation was the basis for testing in the Panama Canal. Results from tests employing the airborne electrical charging system, while initially inconsistent, gave evidence of increasing positive effects as system modification was accomplished in the field. Charged bubble experiments, while theoretically sound, presented problems with regard to bubble production and buoyancy as well as targeting. With the airborne electrical charging system in a more advanced state of design and giving promise for a more immediate fog dispersal system, the charged bubble concept should be relegated to engineering improvement until the airborne system is finalized. GRA

N77-31735# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.

CENTRAL PACIFIC VLF SIGNAL SURVEY AND OMEGA WIND ERROR PREDICTIONS

Michael L. Olson Mar. 1977 312 p refs

(Contract NSF C-760)

(PB-267413/3; NCAR-TN-17/IA) Avail: NTIS HC A14/MF A01 CSCL 04B

The wind accuracies are computed for a 13.6 kHz Omega signal between 30 deg N and 30 deg S latitudes for local noon and local midnight conditions in January. The effect of Australia is clearly illustrated. The results are compared with data measured at Majuro Atoll in the Marshall Islands. It is shown that observations near local noon provide the greatest accuracy. At local midnight, when stations with potential modal interference are not used in the wind computation, the regions of acceptable wind errors are decreased. GRA

N77-31736# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

THE 17901AT HONEST JOHN MISSILE NUMBER 1537, ROUND NUMBER 657 ASL (27 APRIL 1977) Meteorological Data Report

Apr. 1977 14 p

(DA Proj. 1T6-65702-D-127)

(AD-A041589; DR-940) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 17901AT Honest John, Missile Number 1537, Round Number 657 ASL, are presented in tabular form. Author (GRA)

N77-31737# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

THE 14806AT LANCE MISSILE NO. 3325, ROUND NO. 297 APT (2 JUNE 1977) Meteorological Data Report

Jun. 1977 35 p

(DA Proj. 1T6-65702-D-127)

(AD-A041594; DR-941) Avail: NTIS MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14806AT Lance, Missile Number 3325, Round Number 297 APT, are presented in tabular form. Author (GRA)

N77-31738# Danish Meteorological Inst., Copenhagen. Geophysical Dept.

PRESENT ACTIVITIES IN THE GEOPHYSICAL DEPARTMENT [IGANGVAERENDE AKTIVITETER I METEOROLOGISK INSTITUTS GEOFYSISKE AFDELINGER]

Jan. 1976 133 p refs In DANISH; ENGLISH summary

(DMI-Geophys-Papers-B-12; P-60) Avail: NTIS HC A07/MF A01

Present activities and research projects at the Department for International Affairs, which runs the World Data Center C1 for geomagnetic recordings are presented together with activities at the Geophysical Department 1 concerning determination of the earth magnetic field over Denmark; real time recording of weather-data transmitted from satellites; and measurements of diurnal and yearly variation of the electron content in the atmosphere within the auroral oval. Work carried out at Geophysical Department 2 is also discussed and involves routine geomagnetic observations from observatories in Greenland (Narssarssuaq - Godhavn - Thule); study of currents in the polar ionosphere and their relation with the interplanetary magnetic field; and investigations of the geographic distribution of precipitation of auroral particles (mainly electrons in the range of 100 eV to 50 keV.) Author (ESA)

N77-31739# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.

MICROCLIMATE AND WINTER SLIPPERINESS. A STUDY OF FACTORS INFLUENCING SLIPPERINESS, WITH APPLICATION OF THERMAL INFRARED OBSERVATION TECHNIQUES

A. Rosema and A. G. Welleman (RWL) 1977 64 p refs

(NIWARS-Publ-38) Avail: NTIS HC A04/MF A01

An investigation into the factors having an effect on the winter slipperiness of roads and the possibility of tracing, by thermal infra-red techniques, those road sections which become slippery first, is reproted. ESA

N77-31740# Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.

A COMPARISON OF THE AIR-SEA INTERACTION FLUX MEASUREMENT SYSTEMS OF THE BEDFORD INSTITUTE OF OCEANOGRAPHY AND THE INSTITUTE OF OCEANOGRAPHY, UNIVERSITY OF BRITISH COLUMBIA

S. D. Smith, R. J. Anderson, E. G. Banke, E. P. Jones, and S. Pond Dec. 1976 50 p refs

(Contract N00014-76-C-0446)
(AD-A040299; BI-R-76-17) Avail: NTIS HC A03/MF A01 CSCL 04/2

A comparison of two air-sea interaction measurement systems was run at Sable Island, N. S., in September and October, 1975. The BIO (Bedford Institute of Oceanography) sensors included thrust and sonic anemometers for wind turbulence measurement, a microbead thermistor, and a Lyman-alpha humidity sensor. The UBC (University of British Columbia) system consisted of a modified Gill propeller-vane anemometer, thermistors, and Brady and aluminum oxide type humidity sensors. Both data sets were recorded in fm analogue form and digitized and analyzed at BIO. The UBC system also made digital recordings, which will be reported elsewhere. Both systems operated together to produce generally comparable results. GRA

N77-31741# Naval Postgraduate School, Monterey, Calif.
NUMERICAL SIMULATION OF AIR FLOW OVER MOUNTAINS Technical Report, Jul. 1976 - Mar. 1977
J. L. Hayes and R. T. Williams Apr. 1977 69 p refs
(AD-A040693; NPS-63WU7741) Avail: NTIS HC A04/MF A01 CSCL 04/2

The nature of the interaction of atmospheric flow with a mountain range of finite length is investigated. An inviscid, adiabatic primitive equation model is used to simulate steady, vertically-unsheared flow past a mountain range; various cases of mountain height and width are analyzed. GRA

N77-31742# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
LABORATORY STUDIES OF COMPRESSED AIR SEEDING OF SUPERCOOLED FOG Special Report
James R. Hicks and Richard C. Rice, Jr. May 1977 23 p refs
(AD-A040633; CRREL-SR-77-12) Avail: NTIS HC A02/MF A01 CSCL 04/2

Some 400 tests were conducted in the CRREL Cold Cloud Chamber to determine the combination of air pressure and nozzle design that yielded the maximum production of ice crystals in a supercooled fog. It was found that some 0.22 cu m/min of air which was compressed to 517 kPa is needed to be effective for clearing a supercooled fog. GRA

N77-31743# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
COMPRESSED AIR SEEDING OF SUPERCOOLED FOG Special Report
James R. Hicks Oct. 1976 12 p
(AD-A040819; CRREL-SR-76-9) Avail: NTIS HC A02/MF A01 CSCL 04/2

Two series of experiments, 25 in a light fog and 25 in a heavy fog, were conducted in the CRREL cold cloud chamber. Compressed air was used to glaciate the -4 C fog. The gage air pressure was 413.7 kPa. These tests showed that the number of ice crystals produced exceeded the number of water droplets in the fog by a factor of 21 for a light fog and 133 for a heavy fog. Approximately 2.6 times as many ice crystals were created in a heavy fog than were created in a light fog. Author (GRA)

N77-31744# Air Force Geophysics Lab., Hanscom AFB, Mass.
VALUES OF DIFFUSION COEFFICIENTS DEDUCED FROM THE CLOSING TIMES OF HELICOPTER-PRODUCED CLEARINGS IN FOG Environmental Research Papers
Vernon G. Plank, Alfred A. Spatola, and David M. Johnson 12 Jan. 1977 22 p refs
(AD-A040778; AFGL-TR-77-0019; AFGL-ERP-590) Avail: NTIS HC A02/MF A01 CSCL 04/2

Values of diffusion coefficients determined from the observed closing times of nine conical-shaped clearings in fog produced by hovering helicopters at Lewisburg, West Virginia, in September 1969 are presented. The values were established following the method of Elliott, assuming that the geometric and diffusive properties of the clearings and surroundings could be approximated by theoretical equations of the type governing the diffusion of heat and water substance in a bounded, circular cylinder of infinite length, with appropriate specification of the condensation conditions. The diffusion coefficients for the experiments ranged in value from 0.7 to 1.9 x 10 to the 5th power sqcm/sec. Summary diagrams are presented to illustrate how a cylindrical or slot-shaped clearing will close-in with time, dependent on the values of the diffusion coefficient and on the initial temperature and humidity differences between clearing and surrounding. GRA

N77-31745# Air Force Geophysics Lab., Hanscom AFB, Mass.
INVESTIGATION OF SENSORS AND TECHNIQUES TO AUTOMATE WEATHER OBSERVATIONS Instrumentation Papers
Eugene Y. Moroz 11 Feb. 1977 19 p refs
(AD-A040747; AFGL-TR-77-0041; AFGL-IP-253) Avail: NTIS HC A02/MF A01 CSCL 04/2

Several sensors and techniques currently being investigated at the Air Force Geophysics Laboratory as part of its program to automate the observation of weather parameters are described. Included are a lidar cloud-height measuring system, a laser weather identifier, a decision tree approach for determination of present weather, a lidar slant visual range measuring system, and a tower mounted visibility meter approach for determination of slant visual range. Author (GRA)

N77-31746# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
A STUDY OF FORECAST ERRORS IN AN OPERATIONAL MODEL FOR PREDICTING PATHS OF TROPICAL STORMS
Frederick Sanders and Norma J. Gordon Dec. 1976 57 p refs
(Contract F19628-75-C-0059)
(AD-A040935; Scientific-2; AFGL-TR-77-0079) Avail: NTIS HC A04/MF A01 CSCL 04/2

The SANBAR forecasts, made operationally at the National Hurricane Center during the 1975 hurricane season, are studied. The forecast model is a barotropic one designed explicitly for predicting the tracks of tropical storms, and is based on direct analysis of the wind field averaged through the depth of the troposphere. An assessment is made of the possible impact of increased use of satellite observations in the initial analysis, but we are also interested in identifying the various sources of forecasts error, including (but not limited to) faulty initial analysis. GRA

N77-31747# Naval Weather Service Detachment, Asheville, N.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS (SSMO). SOUTH AMERICA AND SELECTED ISLAND COASTAL MARINE AREAS, ATLANTIC ISLANDS. VOLUME 3: AREA 17 TIERRA DEL FUEGO, AREA 18 - FALKLAND ISLANDS, AREA 19 - SOUTH GEORGIA, AREA 20 TRISTAN DA CUNHA GROUP, AREA 21 - TRINDADE, AREA 22 - ST. HELENA, AREA 23 - ASCENSION, AREA 24 - ST. PETER AND PAUL ROCKS
Jun. 1977 653 p
(AD-A040487) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report presents marine climatological data for specific coastal areas in 21 different tables including weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressure. Author (GRA)

N77-31748# Nevada Univ., Reno.
THE PYRAMID LAKE PILOT PROJECT, 1970 TO 1975. VOLUME 1: TEXT OF REPORT Final Report
Jan. 1977 257 p refs Sponsored in Part by ONR Prepared in cooperation with Calif. Univ. Berkeley
(Contract DI-14-06-D-7000)
(PB-266951/3) Avail: NTIS HC A12/MF A01 CSCL 04B

A randomized cloud seeding project was carried out over an area of 1052 sq mi near Lake Tahoe for 3 winter-spring seasons. Six remotely controlled silver iodide generators were located on the upper western slopes of the Sierra Nevada, and precipitation was measured by means of 23 recording guages and 54 nonrecording gauges. The varying duration of experimental periods was taken into account by assuming a gamma distribution of precipitation amounts, with the shape parameter a linear function of duration; the effect of seeding then appeared as a change in the scale parameter. GRA

N77-31749# Nevada Univ., Reno. Lab. of Atmospheric Physics.
THE PYRAMIC LAKE PILOT PROJECT, 1970 TO 1975. VOLUME 2: APPENDICES Final Report
Patrick Squires Jan. 1977 226 p refs Prepared in Cooperation with Calif. Univ., Berkeley
(Contract DI-14-06-D-7000)
(PB-266952/1) Avail: NTIS HC A11/MF A01 CSCL 04B
For abstract, see N77-31748.

N77-31750# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
PROCEEDINGS OF THE 4TH NATIONAL CONFERENCE ON FIRE AND FOREST METEOROLOGY
Douglas H. Baker and Michael A. Fosberg Nov. 1976 248 p refs Proc. held at St. Louis, 16-18 Nov. 1976
(PB-267108/9; FSGTR/RM-32) Avail: NTIS HC A11/MF A01 CSCL 02F
Sessions were held on land managers' needs for weather service and advice; current weather forecasting capabilities; fire danger and weather; atmospheric aspects of forest insect and disease control; meteorology and land use; and influence of atmospheric pollutants on biological systems. GRA

N77-31751# National Weather Service, Silver Spring, Md.
NATIONAL WEATHER SERVICE FORECASTING HANDBOOK NO. 1. FACSIMILE PRODUCTS
Robert E. Rieck, Alexander F. Sadowski, and John J. Harrell Jul. 1976 256 p
(PB-267389/5; NOAA-77041902) Avail: NTIS HC A12/MF A01 CSCL 04B
The handbook has been developed in an attempt to systematically explain to the forecaster in the field the method of production of facsimile products in the National Weather Service, and what the facsimile product is intended to do, or show. Formats are shown and explained as well as the theory behind the products. GRA

N77-31752# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
PROJECT SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT (SESAME). PLANNING DOCUMENTATION VOLUME
Douglas K. Lilly, ed. Jan. 1977 315 p refs
(PB-267084/2; NOAA-77041309) Avail: NTIS HC A14/MF A01 CSCL 04B
Reports are presented from a planning conference on boundary layers and regional scale modelling, another on the storm scale program, two smaller planning group meetings on gravity wave interactions and satellite data and two significant reports by committees not directly associated with SESAME. Three reprints of relevant journal articles are also included. GRA

N77-31753# Florida State Univ., Tallahassee. Dept. of Meteorology.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 34: METEOROLOGICAL DATA-JOINT 2: MARCH, APRIL, MAY 1976
David W. Stuart, Mark A. Spetseris, and Mark M. Nanney Nov. 1976 74 p refs
(PB-267525/4; FSU-CUEA-MET-76-2; NSF/IDOE-77-102) Avail: NTIS HC A04/MF A01 CSCL 04B
Documentation of the various meteorological observations made in support of the JOINT II experiment in coastal upwelling conducted along the Peruvian coast during March, April, and May 1976 is presented. Details of the instruments, observational techniques, and data recording systems, digitizing and reduction techniques are discussed. Selected parameters from land stations are presented as time plots. All sea surface temperature maps and profiles prepared via the aircraft are included. Details for obtaining any of the meteorological data are discussed. GRA

N77-31754# Florida State Univ., Tallahassee. Dept. of Meteorology.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. TECHNICAL REPORT 32: A STUDY OF THE MESOSCALE WIND CIRCULATION IN A LAND-SEA BREEZE REGIME
Jeffrey D. Hawkins Jan. 1977 48 p refs
(PB-267412/5; FSU-CUEA-MET-77-3; NSF/IDOE-77-97) Avail: NTIS HC A03/MF A01 CSCL 04B
The mesoscale wind circulation along the central Oregon coast is investigated. Buoy and coastal land station data were combined and correlated by first digitizing all parameters necessary to plot time series and diurnal plots of: the air and sea surface temperature; the horizontal wind components; and the wind speed. The time interval with prevailing N-NW winds had the following characteristics: (1) a well defined sea breeze event with supporting coastal temperature differential and less significant land breeze; (2) the formation of an eddy south of Cape Lookout; and (3) strong upwelling and sea surface temperatures affected by surface winds. GRA

N77-31755# Florida State Univ., Tallahassee. Dept. of Meteorology.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. TECHNICAL REPORT 29: AIRCRAFT-OBSERVED WINDS OVER A COASTAL UPWELLING REGION M.S. Thesis
William Paul Duval Jan. 1977 138 p refs Sponsored by NSF
(PB-267369/7; FSU-CUEA-MET-77-1; NSF/IDOE-77-99) Avail: NTIS HC A07/MF A01 CSCL 04B
The relationships of aircraft-observed wind and sea surface temperature data with available surface data were examined. Analysis of the two-dimensional wind field showed a high degree of temporal and spatial variability. Some evidence was seen of a feedback mechanism whereby the establishment of coastal upwelling, as seen by lower sea surface temperatures, resulted in an intensified northerly v-component along the coast, which in turn helped to maintain and intensify the coastal upwelling. The upwelling cycle appeared to a be related to a regular cycle in the synoptic-scale sea-level wind and pressure pattern. GRA

N77-31756# Florida State Univ., Tallahassee. Dept. of Meteorology.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. TECHNICAL REPORT 31: A STUDY OF THE MEAN LAND-SEA BREEZE CONDITIONS OVER THE NORTHWEST AFRICA COAST DURING THE PERIOD 6-30 MARCH 1974 M.S. Thesis
Robert E. Kilduff Jan. 1977 131 p refs Sponsored by NSF
(PB-267372/1; FSU-CUEA-MET-77-2; NSF/IDOE-77-98) Avail: NTIS HC A07/MF A01 CSCL 04B
Meteorological data were obtained via land and buoy surface stations, pilot balloons, radiosondes, and research aircraft along the northwest African coast. Profiles of the diurnal variation of the mean values of temperature, relative humidity, mixing ratio, sea surface temperature, and u- and v- components of the wind are displayed. The diurnal variation of the mean upper air winds at Nouadhibou is displayed for each period and mean soundings from aircraft data and radiosondes at Nouadhibou are also displayed. During all periods investigated the sea breeze arrived earlier at the northern coastal stations and there was also a suggestion of a larger scale diurnal monsoon circulation that extended to at least 4 km, and a veering of the wind with time below 2 km. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-31757# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SIMULATION OF OCEAN CURRENTS COMPARED TO OCEANOGRAPHIC AND REMOTE SENSOR DATA IN THE CABO FRIO AREA M.S. Thesis [SIMULACAO DA RESSURGENICA COMPARADA COM DADOS OCEANOGRAFICOS E DE SENSORES REMOTOS EM CABO FRIO]
Keiko Tanaka Jul. 1977 124 p refs In PORTUGUESE; ENGLISH summary
(INPE-1085-TPT/061) Avail: NTIS HC A06/MF A01
A linear mathematical model is presented to simulate wind induced currents over the continental shelf. Calculations were performed, by means of a digital computer, corresponding to a

test area. The coastal currents are first obtained in three dimensions, and then the horizontal divergence and the vertical component of the velocity are calculated. The results were found to be correlated with oceanographic data obtained in situ and with data of the thermal sensor. The simulation showed the existence of stronger SW horizontal currents in the depth range of 100 to 110 m: These currents were identified in the thermal image, by the presence of a strip of cold water oriented in the SW direction. Author

N77-31758# Naval Research Lab., Washington, D. C. Geophysical Simulation Section.

COMPARISON OF THREE DIFFUSION MODELS OF THE UPPER MIXED LAYER OF THE OCEAN

P. J. Martin 1976 56 p refs
(Contract E(49-26)-1005)
(DSE/1005-4; NRL-GFD/OTEC-4-76) Avail: NTIS HC A04/MF A01

The Munk-Anderson, Vager-Zilitinkevich, and Mellor-Yamada turbulent diffusion models were used to model the upper mixed layer of the ocean and were compared to determine differences in predicted mixed layer depths for simple cases of mixed layer deepening. The mixed layer depths predicted by the models were found to be very strongly dependent upon the value of the Richardson number above which the generation of turbulence by the mean velocity shear was stabilized by the stratification. The larger this critical value of the Richardson number the further the mixed layer deepened before the stratification at the base of the mixed layer was able to suppress the turbulent mixing and stop further erosion of the thermocline. ERA

N77-31759# Naval Postgraduate School, Monterey, Calif.

THE ROLE OF STRONG ATMOSPHERIC FORCING EVENTS IN THE MODIFICATION OF THE UPPER OCEAN THERMAL STRUCTURE DURING THE COOLING SEASON Ph.D. Thesis

Norman Thomas Camp Dec. 1976 178 p refs
(AD-A039346) Avail: NTIS HC A09/MF A01 CSCL 08/3

The role of strong atmospheric forcing events in determining the evolution of the upper ocean during the fall and early winter cooling season was investigated. The historical series of surface and near-surface marine observations at three mid-latitude ocean weather ships (PAPA (OWS P), NOVEMBER (OWS N), and VICTOR (OWS V)) support the hypothesis that the integrated effects of these events dominate this evolution. For example, periods when the mechanical forcing was greater than the long-term mean accounted for approximately 35% of the time in the record examined at the three stations. However 85%/68%/57% of the sea-surface temperature change at OWS N/OWS P/OWS V occurred during these periods. Forty-nine data sets were examined and modeled during periods of intense fall and winter forcing. The significant thermal structure modifications observed during these strong events were simulated successfully using three modifications of the Kraus and Turner (1967) one-dimensional model. Evidence is presented which demonstrates that the amount of mechanically-generated turbulent kinetic energy available for entrainment decreases as the mixed-layer depth increases. Furthermore, in agreement with Gill and Turner (1976), these case studies suggest that only a small percentage of the convectively-generated turbulent kinetic energy is available for increasing the potential energy of the ocean by entrainment. Author (GRA)

N77-31760# United States POLYMODE Organizing Committee, Cambridge, Mass.

US POLYMODE PROGRAM AND PLAN

Dec. 1976 95 p refs Sponsored in part by Navy
(PB-267361/4; NSF/IDOE-77-100) Avail: NTIS HC A05/MF A01 CSCL 08C

POLYMODE is an effort to obtain the minimum data-base which will enable oceanographers to make a major thrust forward in modelling capability. The overall scientific objectives of the U.S. POLYMODE Program is: (1) to carry out field observations and experiments, primarily in open ocean regions of the western North Atlantic designed as far as possible to advance knowledge of the kinematics and dynamics of the variability in that region and to determine their role in the circulation of the North Atlantic subtropical gyre, and (2) to pursue theoretical/numerical modelling of the phenomenon and to apply state-of-the-art theory to the design and rationalization of the POLYMODE field data via both local forecast-process numerical models and high resolution numerical models of the North Atlantic gyre general circulation. GRA

N77-31761# Connecticut Univ., Storrs. Inst. of Water Resources.

DRIFT VELOCITIES OF SURFACE FILMS OVER WAVES M.S. Thesis

Michael Carl Mohr 1977 97 p refs
(Contract DI-14-31-0001-5007; OWRT Proj. A-059-CONN(1))
(PB-267661/7; W77-08193) Avail: NTIS HC A05/MF A01 CSCL 13B

The analysis of the convection of an oil slick under oceanic conditions is an essential tool for pollution control operations. The drift of an oil slick on the sea is under the influence of both wind and waves. Research was initiated to study the convection of a surface film under the action of wind- and mechanically-generated waves in a laboratory wind-wave channel by using polyethylene sheets. GRA

N77-31762# North Carolina State Univ., Raleigh.

THE CITIZEN'S GUIDE TO NORTH CAROLINA'S SHIFTING INLETS

Simon Baker Mar. 1977 36 p
(Grant NOAA-04-6-058-44054)
(PB-268736/6; UNC-SG-77-08; Information-2;
NOAA-77051101) Avail: NTIS HC A03/MF A01 CSCL 08F

This pamphlet is intended for the use of citizens who do not have a scientific or engineering background. Aerial photographs are marked to show the numerous significant changes in the position and size of barrier islands and inlets caused by various coastal processes. GRA

N77-31763# California Univ., San Diego. Inst. of Marine Resources.

COASTAL ENGINEERING DATA NETWORK Semiannual Report, Jul. - Dec. 1976

Richard J. Seymour (Calif. State Dept. of Navigation and Ocean Development, Sacramento), Meredith H. Sessions, Stephen L. Wald, and Albert E. Woods Jan. 1977 153 p
(Grant NOAA-04-6-158-44110)
(PB-268891/9; IMR-77-103; Sea Grant Pub-56;
NOAA-77051808; SAR-2) Avail: NTIS HC A08/MF A01 CSCL 08C

The network is devoted primarily to the collection of long-term wave statistics from a large number of nearshore locations, although the capability to collect other nearshore data exists. A fifth station measures sediment transport at the Channel Islands Breakwater north of Port Hueneme. A special interface was constructed so that the output of the wave gage would be compatible with the rest of the system. The system was in operation for slightly more than a year. During this period approximately 3,000 data runs or 3 million points were collected with an overall success rate of 95%. The availability of a year's data from a site allows for some meaningful analysis of the wave climate. The appendix contains the monthly reports for July 1976 through Dec. 1976. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-31764# Rochester Univ., N. Y. Dept. of Microbiology.

THE PHYSIOLOGICAL BASES FOR MICROBIAL BAROTOLERANCE Annual Report

Robert E. Marquis 31 Mar. 1977 36 p refs
(Contract N00014-75-C-0634)
(AD-A037840; TR-5) Avail: NTIS HC A03/MF A01 CSCL 06/19

Investigations during the past year of the effects of high-pressure narcotic gases have confirmed previous reports of inhibition of microbial growth and differentiation. Spore germination was found to be somewhat more sensitive than was growth, and for example, germination of Bacillus cereus spores could be

completely suppressed by only 10 atmospheres of nitrous oxide, compared with some 25 atmospheres required for 50% inhibition of growth of Streptococcus faecalis. High-pressure helium at 24 to 41 atmospheres was found to act oppositely in that it stimulated streptococcal growth and replication. Helium did act to enhance the narcotic potential of nitrous oxide and to increase oxygen toxicity. The oxygen pressure required for 50% growth inhibition was about 25 atmospheres, approximately the pressure of nitrous oxide required for the same effect. However, long-term exposure to oxygen resulted in cell death, while similar exposure to nitrous oxide resulted in no killing. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-31765*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 170
Aug. 1977 58 p refs
(NASA-SP-7011(170)) Avail: NTIS E02 CSCL 06E

This bibliography lists 160 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1977. Author

N77-31766# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TOXIC HAZARDS TESTS FOR VEHICLES AND OTHER EQUIPMENT Final Report
17 Jan. 1977 26 p refs Supersedes MTP-2-2-614
(AD-A040542; TOP-2-2-614; MTP-2-2-614) Avail: NTIS HC A03/MF A01 CSCL 13/6

This report provides test operating procedures for measuring carbon monoxide and other toxic gas concentrations produced during the operation of military vehicles and accessories, including the firing of armament. It includes measurements in work areas where engines and engine-driven equipment are operated, and describes equipment and instrumentation, standards for exposure limits, and physiological effects of exposures. It includes measurements of gases during: vehicle tests with engines and other fuel-burning accessories operating, firing tests of vehicle-mounted weapons, firing tests of vehicular weapons in test chambers, and operation of miscellaneous engine-driven equipment such as generators and compressors. GRA

N77-31767# Human Engineering Labs., Aberdeen Proving Ground, Md.
A PROPOSAL FOR EVALUATING HUMAN EXPOSURE TO CARBON MONOXIDE CONTAMINATION IN MILITARY VEHICLES Final Report
Seymour Steinberg and Gerald D. Nielsen Mar. 1977 28 p refs
(AD-A040799; HEL-TM-11-77) Avail: NTIS HC A03/MF A01 CSCL 06/10

Presently, the Army evaluates the severity of CO toxic hazard to weapon system crews by applying the same Occupational Health and Safety Administration (OSHA) standards used when evaluating toxic hazard to the industrial/civilian community. A more realistic method of evaluation for Army personnel is proposed which accounts for the CO actually inspired by the exposed individual by predicting the carboxyhemoglobin (COHb) in the blood at any time during and subsequent to the exposure. The prediction (calculated by an empirical equation) is based upon knowledge of the ambient CO concentration, the duration of the exposure and the physical exertion of the exposed person. COHb blood content is closely related to the medical effects of CO exposure and is the prime basis for both the evaluation procedure and the standard proposed in this report. Additional subjects discussed in this report include the chronology of civilian and military standards and limits governing CO exposure, the test requirements including details which are necessary to implement the proposed evaluation method and suggested areas for future research for reducing CO exposure and potentially improving vehicle design. Also included is an example which applies the COHb equation (for predicting COHb blood content) to some hypothetical data. GRA

N77-31768# Technology, Inc., San Antonio, Tex.
EVALUATION OF NON-INVASIVE PHYSIOLOGIC MEASUREMENT TECHNIQUES Final Report, Oct. 1974 - Oct. 1975
Norma D. Miller Dec. 1976 258 p refs
(Contract F41609-75-C-0011; AF Proj. 7930)
(AD-A041242; SAM-TR-76-34) Avail: NTIS HC A12/MF A01 CSCL 06/2

This report is based on a search of the scientific literature for relevant non-invasive techniques for monitoring physiologic responses to high sustained -Gz (HSG). Specifically, techniques are described and evaluated as to their potential for providing rapid and reliable measures of respiratory, cardiovascular, metabolic, sensory and cerebral functions in human centrifugation studies. The evaluation ratings reflect the criteria of accuracy, stability, and sensitivity of the recording instrumentation as well as the directness of the measurement technique and resistance to contamination from artifacts from ambient or physiologic noise. GRA

N77-31769# Saint Louis Univ., Mo. Dept. of Physiology.
THE INVESTIGATION OF METABOLIC AND CARDIOVASCULAR RESPONSES TO FATIGUING STATIC EFFORT Final Scientific Report, Jun. 1972 - Jul. 1976
A. R. Lind, H. Barcroft, J. S. Petrofsky, J. Rinehart, and T. E. Dahms Jul. 1976 305 p refs
(Grant AF-AFOSR-2362-72; AF Proj. 9777)
(AD-A037975; AFOSR-77-0312TR) Avail: NTIS HC A14/MF A01 CSCL 06/19

The research reported covers several approaches to the problem of isometric fatigue based on the working hypothesis that muscular fatigue is metabolic in nature. Obtained data support several important conclusions--at tensions of 70 percent maximum voluntary contraction fatigue is metabolic while at lower tensions some degree of transmission failure occurs, the integrated electromyogram per se is not a good measure of muscular fatigue but the frequency of the power spectrum may be; fatigue induced by isometric contractions is peripheral and does not involve central nervous fatigue. GRA

N77-31770# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
CARDIOVASCULAR, RENAL AND RESPIRATORY EFFECTS OF HIGH INTENSITY, INTERMEDIATE DURATION, LOW FREQUENCY VIBRATION Interim Report, 1 Jul. 1975 - 30 Jun. 1976
Robert M. Nerem, Robert L. Hamlin, and George M. Pantalos 31 Jul. 1976 23 p
(Grant AF-AFOSR-2526-73; AF Proj. 9777)
(AD-A037978; AFOSR-77-0319TR; IR-3) Avail: NTIS HC A02/MF A01 CSCL 06/19

A research program on the influence of high intensity, intermediate duration, low-frequency wholebody vibration on the cardiovascular, renal and respiratory systems is described. During the period 1 July 1975 to 30 June 1976, emphasis was placed on the in vitro study of the transport of C14-4-cholesterol between blood and the arterial wall in the presence of oscillatory flow conditions. In addition, a previous in vivo investigation of I(131)-albumin transport in the aorta was extended to include measurements during vibration at 6 and 14 Hz. These in vivo studies indicate an enhancement of albumin uptake during vibration in the dog aorta. The in vivo data are consistent with in vitro data and the concept of a shear-dependent transport process. Continuing in vivo studies are being carried out to measure aortic pressure and velocity waveforms. GRA

N77-31771# Naval Aerospace Medical Research Lab., Pensacola, Fla.
VISUAL COUNTERACTION OF NAUSEOGENIC AND DISORIENTING EFFECTS OF SOME WHOLE-BODY MOTIONS: A PROPOSED MECHANISM Interim Report
Fred E. Guedry, Jr. 16 Feb. 1977 20 p refs
(MF51524004)
(AD-A038767; NAMRL-1232) Avail: NTIS HC A02/MF A01 CSCL 06/19

It has been indicated that the nauseogenic and disorienting

effects of several kinds of provocative motion stimuli can be ameliorated by visual reference to the Earth. The purpose of the present experiment is to investigate a hypothesis concerning the mechanism of this beneficial effect. The results demonstrate that the aftereffects of large-field optokinetic stimulation can nullify the nauseogenic and disorienting effects of Coriolis cross-coupled vestibular stimuli. It is hypothesized that large-field optokinetic stimulation in a particular head plane modifies activity in the vestibular nuclei as though the semicircular canals in that plane had been stimulated. GRA

N77-31772# Mayo Foundation, Rochester, Minn. Dept. of Physiology and Biophysics.

PROTECTION OF THE CARDIOPULMONARY SYSTEMS AGAINST THE INJURIOUS EFFECTS OF ACCELERATION Final Scientific Report, 1 Jul. 1971 - 30 Jun. 1976

E. H. Wood and P. A. Chevalier Aug. 1976 106 p refs
(Contract F44620-71-C-0069; AF Proj. 9777)
(AD-A038014; AFOSR-77-0316TR) Avail: NTIS HC A06/MF A01 CSCL 06/19

The investigators have developed a single source computerized X-ray fluoroscopic system for three-dimensional reconstruction and display of moving organs, particularly the heart, lungs and circulation which provide the potential for studies in intact animals and humans of the dynamic anatomy and associated functions of moving organs in ways never before achievable. For example, these techniques can be used with the subjects in a variety of positions, such as prone, supine, right and left lateral decubitus, and under conditions of increased gravitational-inertial stress such as might be experienced in aerial combat maneuvers. This allows investigations of the relationships of the dynamic three-dimensional structural geometry to the physical and biochemical functions of both moving and stationary organ systems. GRA

N77-31773# California Univ., Davis.

SYSTEMS ANALYSIS OF PHYSIOLOGICAL PERFORMANCE RELATED TO STRESSES SUCH AS THOSE EXPERIENCED IN HIGH PERFORMANCE AIRCRAFT Final Scientific Report, 1 Oct. 1971 - 30 Sep. 1976

Richard F. Walters 31 Dec. 1976 42 p refs
(Contract F44620-72-C-0011)
(AD-A038187; AFOSR-77-0318TR) Avail: NTIS HC A03/MF A02 CSCL 06/19

A final summary of contract work performed during the five year period October 1, 1972 through September 30, 1976 is presented. Results of the contract include significant findings in information systems technology, physiology of exercise, and instrumentation associated with human subject experiments in human physical performance. Author (GRA)

N77-31774# Occupational Safety and Health Administration, Washington, D. C.

INORGANIC LEAD

28 Feb. 1977 132 p refs
(PB-266162/7; OSHA-EIS-77-0218-D) Avail: NTIS HC A07/MF A01 CSCL 06J

OSHA proposes to regulate employee exposure to lead by limiting the exposure to an eight hour time weighted average concentration of 100 micrograms of lead per cubic meter of air. The proposal provides for the determination of employee exposure, methods of compliance, personal protective equipment and clothing, training, medical surveillance, and recordkeeping. A beneficial impact on the workplace environment is that there should be a general improvement in the health of workers. GRA

N77-31775# Mount Sinai Medical Center, Miami Beach, Fla. Div. of Pulmonary Diseases.

EFFECTS OF G-INDUCED STRESS ON PULMONARY CIRCULATION Final Report, 21 Dec. 1973 - 15 May 1975

Marvin A. Sackner and Adam Wanner Dec. 1976 79 p refs
(Contract F41609-74-C-0011)
(AD-A040109; SAM-TR-76-28) Avail: NTIS HC A05/MF A01 CSCL 06/19

These studies evaluated pulmonary circulation under mild gravitational stresses, such as water immersion and passive tilt to the upright position. They extended previous observations that the standard USAF anti-G suit might be more efficient if inflated from below upwards, rather than from the abdominal bladder. A modified anti-G suit was designed with pressure switches that enabled sequential filling from below upward. Utilizing the rebreathing technique previously developed for pulmonary circulatory parameters the authors measured the effects on pulmonary circulatory parameters of water immersion to the neck (NI). They demonstrated that, in the seated subject, such NI caused a significant increase in pulmonary capillary blood flow and diffusing capacity which persisted throughout the 4-hr immersion period. The lack of change in pulmonary tissue volume suggested that the central vascular engorgement so induced is not accompanied by extravasation of fluid into the pulmonary interstitial space. The study thus supports the concept that, in the seated subject, the renal or hormonal effects of NI are mediated by a redistribution of blood volume, with a resultant central hypervolemia. GRA

N77-31776# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

IMPLEMENTATION OF A METHOD TO DETECT THE SINGLE VISUAL EVOKED RESPONSE M.S. Thesis

Charles E. Macomber Jan. 1977 59 p refs
(AD-A039756; AFIT/GE/EE/77-1) Avail: NTIS HC A04/MF A01 CSCL 06/2

The visually evoked response (VER) is one neural response to an external event. Although, with computer averaging techniques the evoked response to a particular stimulus is readily available, there are anticipated applications which require detection of the VER after a single stimulus presentation. The approach in this report is based on the similarity of the problem to that of radar detection in which a known signal is buried in noise. Using discrete Fourier transform and other digital signal processing techniques, a filter matched to the VER template was computed and implemented on a digital computer. Computation of the matched filter required an estimate of the noise power spectrum, where the noise in this case is the on-going electrical activity of the brain. Results indicate that the matched filter will detect the single evoked response. However, the false alarm rate is high. GRA

N77-31777# Naval Postgraduate School, Monterey, Calif.

DISSECTION AND ANALYSIS OF ELECTROENCEPHALOGRAMS OF SUBJECTS DOING A SIMULATED PILOT'S TASK M.S. Thesis

Daniel Floyd Lashbrook Mar. 1977 69 p refs
(AD-A039925) Avail: NTIS HC A04/MF A01 CSCL 06/5

A method for dissecting and analyzing electroencephalograms for the presence of any distinctive characteristics is presented. Data are presented which strongly indicate the presence of a preferred frequency, in the 70 - 95 Hz range, that is a characteristic of the performance of a simulated pilot's task. A conclusive test for the presence of wideband noise in the EEG is presented with data to show that wideband noise is characteristic of myograms. EEGs taken from two closely spaced electrodes located over the motor and premotor areas of the cortex show that tegules in the 70 - 95 Hz band are not simultaneous with tegules of any other band, except by chance. Author (GRA)

N77-31778# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.

CRITERIA FOR A RECOMMENDED STANDARD: OCCUPATIONAL EXPOSURE TO ALLYL CHLORIDE

Sep. 1976 99 p refs
(PB-267071/9; DHEW/PUB/NIOSH-76/204; NIOSH-76/204)
Avail: NTIS HC A05/MF A01 CSCL 06J

Provisions are included for sampling, collection, analysis, pre-employment medical examination, periodic examinations, first-aid, medical records, labeling and posting, personal protective equipment (respiratory protection including respirator requirements, eye protection and skin protection), informing employees, emergency procedures involving allyl chloride, control of airborne allyl chloride storage, handling and general work practices, waste disposal, confined spaces, sanitation, monitoring and recordkeeping. Criteria include the purpose of the standards, and biologic effects of exposure. GRA

N77-31779# National Inst. for Occupational Safety and Health, Cincinnati, Ohio.

CRITERIA FOR A RECOMMENDED STANDARD: OCCUPATIONAL EXPOSURE TO ACETYLENE
Jul. 1976 96 p refs
(PB-267068/5; DHEW/PUB/NIOSH-76/195) Avail: NTIS HC A05/MF A01 CSCL 06J

Recommendations are given for an occupational exposure standard for acetylene. Sections include recommendations for an acetylene standard based on environmental, medical, labeling and posting, and other factors; biologic effects of exposure dealing with extent of exposure, historical reports, effects on humans, epidemiologic studies, animal toxicity, correlation of exposure and effect, and carcinogenicity, mutagenicity, and teratogenicity; environmental data; development of a standard; work practices; and research needs. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-31780# Naval Training Analysis and Evaluation Group, Orlando, Fla.
ACADEMIC ATTRITION FROM NAVY TECHNICAL TRAINING CLASS A SCHOOL COURSES Final Report, Nov. 1976 - Jun. 1977
Morris G. Middleton, William C. Rankin, Eric K. Green, and Clarence J. Papetti Jul. 1977 59 p refs
(TAEG-47) Avail: NTIS HC A04/MF A01

Attrition of enlisted personnel during first tour enlistment, a major concern in the all volunteer U.S. Navy, is discussed. Attrition from the A school training environment was perceived to be a part of the overall attrition problem. An investigation of 147 AI and A3 Navy courses was done to identify factors associated with academic attrition, and to determine the overall and course specific costs of academic attrition. Work was also done to identify the extent and pattern of attrition in class AI and A3 courses and to suggest corrective courses of action for monitoring, controlling, or reducing academic attrition. Author

N77-31781# Yale Univ., New Haven, Conn. Dept. of Psychology.
VERBAL FLUENCY AND THE LANGUAGE-BOUND EFFECT
Ruth S. Day May 1977 50 p refs
(Contract N00014-75-C-0967; NR Proj. 154-378)
(AD-A040830; TR-1) Avail: NTIS HC A03/MF A01 CSCL 05/10

Individuals previously identified as language-bound (LB) and language- optional (LO) participated in a series of experiments designed to study verbal fluency. The two groups showed a striking similarity in the number of responses they produced for categories with constraints at various levels (word form, word content, sentence, interpretation). This similarity occurred for both written and oral modes of response, and over a wide range of time intervals. Other types of measures, however, suggested that the form(s) in which a given category can be represented affected the ease with which the two groups produced their responses. LBs had more difficulty with categories that lent themselves readily to a spatial representation, while LOs had more difficulty with a cateogry based on phonetic constraints. The results were considered in terms of their implications for the LB phenomenon as well as general approaches to the study of verbal fluency. GRA

N77-31782# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
FEASIBILITY STUDY TO PREDICT COMBAT EFFECTIVENESS FOR SELECTED MILITARY ROLES: FIGHTER PILOT EFFECTIVENESS Final Report, 1 Feb. 1976 - 30 Apr. 1977
Edward W. Youngling, Sheldon H. Levine, John B. Mocharnuk, and Louise M. Weston 29 Apr. 1977 404 p refs
(Contract MDA903-76-C-0169)
(AD-A041650; MDC-E1634) Avail: NTIS HC A18/MF A01 CSCL 05/9

This study focuses upon enhancing the U.S. record of air-to-air combat kills through more stringent and comprehensive selection procedures. Specifically, it presents empirical evidence which demonstrates that a program can be developed to select pilots who will be effective in air-to-air combat. Developing such a selection program involves a job analysis of the fighter pilot task, the generation of testable trait hypotheses, the development of predictor variables and peacetime and combat criteria, and validation and cross validation during peacetime and during combat. Forty-five factors were identified only 10 of which are adequately evaluated within a current U.S. military selection program upon initial entrance into pilot training. Assessment of the 35 untapped factors is within technological reach; in fact, many of these factors can be assessed by tests which are presently available. GRA

N77-31783# Advisory Group for Aerospace Research and Development, Paris (France).
THE PSYCHO-PATHOLOGY OF THE STUDENT PILOT AND MEDICO-PSYCHOLOGICAL MONITORING IN THE FLYING SCHOOL
J. R. Galle-Tessoneau (Centre Medical de Psychologie Clinique de l'Armee de l'Air, Paris) Aug. 1977 45 p refs
(AGARD-AG-227; ISBN-92-835-0201-9) Avail: NTIS HC A03/MF A01

The practice of medicine among the population of young student pilots is discussed in terms of interest for the young doctor. It is suggested that the going beyond the affected organ, the 'symptom presented', tries to understand the whole of the personality he is examining. The medical manifestations most often encountered with student pilots are reviewed. Author

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-31784* Nebraska Univ., Lincoln. Dept. of Engineering Mechanics.
ANALYSIS AND DESIGN OF A PROTO-TYPE TRIPLE-AXIS-COMMON-PIVOT-ARM-WRIST TO BE EVALUATED ON ESAM AND P-FMA. PHASE 1 Final Report
Leender Kersten Aug. 1977 118 p
(Contract NAS8-31897)
(NASA-CR-150375) Avail: Issuing Activity CSCL 05H

The performance characteristics and requirements are described for an arm/wrist assembly of a manipulator whose drive system uses a backdriveable gear train allowing for a 20.5 N-m (15 ft lb) torque delivery in each of the joint movements. Topics discussed include materials and weight specifications, sizing of various gear sets, a mathematical model for thermal analysis, and purchased components and vendors. Detail and assembly drawings of the components are presented along with the computer program use for thermal analysis. A.R.H.

N77-31785*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
VALIDATION OF THE PASSENGER RIDE QUALITY APPARATUS (PRQA) FOR SIMULATION OF AIRCRAFT MOTIONS FOR RIDE-QUALITY RESEARCH
William B. Bigler, II Apr. 1977 69 p refs
(Grant NGR-47-005-181)
(NASA-CR-154892; UVA/528060/ESS77/108) Avail: NTIS HC A04/MF A01 CSCL 05H

The NASA passenger ride quality apparatus (PRQA), a ground based motion simulator, was compared to the total in flight simulator (TIFS). Tests were made on PRQA with varying stimuli: motions only; motions and noise; motions, noise, and visual; and motions and visual. Regression equations for the tests were obtained and subsequent t-testing of the slopes indicated that ground based simulator tests produced comfort change rates similar to actual flight data. It was recommended that PRQA be used in the ride quality program for aircraft and that it be validated for other transportation modes. Author

N77-31786*# Ionics, Inc., Watertown, Mass.
WATER VAPOR DIFFUSION MEMBRANE DEVELOPMENT Final Report
Michael K. Tan 26 Jul. 1977 65 p
(Contract NAS2-7651)
(NASA-CR-152037) Avail: NTIS HC A04/MF A01 CSCL 06K

An application of the water vapor diffusion technique is examined whereby the permeated water vapor is vented to space vacuum to alleviate on-board waste storage and provide supplemental cooling. The work reported herein deals primarily with the vapor diffusion-heat rejection (VD-HR) as it applies to the Space Shuttle. A stack configuration was selected, designed and fabricated. An asymmetric cellulose acetate membrane, used in reverse osmosis application was selected and a special spacer was designed to enhance mixing and promote mass transfer. A skid-mount unit was assembled from components used in the bench unit although no attempt was made to render it flight-suitable. The operating conditions of the VD-HR were examined and defined and a 60-day continuous test was carried out. The membranes performed very well throughout the test; no membrane rupture and no unusual flux decay was observed. In addition, a tentative design for a flight-suitable VD-HR unit was made.
Author

N77-31787*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SEAT CUSHION TO PROVIDE REALISTIC ACCELERATION CUES FOR AIRCRAFT SIMULATOR PILOTS Patent Application
Billy R. Ashworth, inventor (to NASA) Filed 31 Aug. 1977 14 p
(NASA-Case-LAR-12149-1; US-Patent-Appl-SN-829314) Avail: NTIS HC A02/MF A01 CSCL 05H

A seat cushion for providing realistic acceleration cues to an aircraft simulator pilot was developed. A plurality of contiguous seat cushion compartments, each including a pressure controlled air cell with a noncompressible surface underneath, were provided. Means were available for initially controlling the air pressure in the air cells to allow the tuberosities of the simulator pilot to touch the noncompressible surface and thus begin to compress the flesh near these areas. During a simulated flight means were provided for controlling the air pressure in the cells to simulate the events that occur in a seat cushion during actual flight.
NASA

N77-31788# Navy Experimental Diving Unit, Panama City, Fla.
MK 12 SSDS AIR MODE TECHNICAL EVALUATION T/S 283 Final Report
B. A. Ridgewell 6 Jul. 1976 62 p refs
(AD-A039607; NEDU-4-76) Avail: NTIS HC A04/MF A01 CSCL 06/17

Summary of the Technical Evaluation Testing of the MK 12 Surface Supported Diving System, air mode. Compares required characteristcs and operational parameters with test results. Concludes that the system is ready for Operational Evaluation.
Author (GRA)

N77-31789# Aerospace Systems, Inc., Burlington, Mass.
PILOT MODELING FOR MANNED SIMULATION. VOLUME 2: PROGRAM PIREP USER MANUAL Final Report, Apr. 1975 - Feb. 1976
Kristine M. Doyle and William C. Hoffman Dec. 1976 52 p refs
(Contract F33615-75-C-3069)
(AD-A040416; ASI-TR-76-29-Vol-2; AFFDL-TR-76-124-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 05/8

A digital computer program (PIREP) has been developed to implement the extended optimal control pilot model discussed in Volume I. The user manual describes the program organization, presents the input formats and program options, provides general comments to assist the user, and presents results for a sample run. The program is written entirely in FORTRAN IV, for operation on the Wright-Patterson computer facility. Author (GRA)

N77-31790# Army Aeromedical Research Lab., Fort Rucker, Ala.
MEASUREMENT OF AVIATOR VISUAL PERFORMANCE AND WORKLOAD DURING HELICOPTER OPERATIONS Final Report
Ronald R. Simmons, Kent A. Kimball, and Jamie J. Diaz Dec. 1976 37 p refs
(AD-A035757; USAARL-77-4) Avail: NTIS HC A03/MF A01 CSCL 06/16

This report was initiated to review the techniques and modifications developed by the U.S. Army Aeromedical Research Laboratory for assessing visual performance/workload of pilots during helicopter operations. Although the corneal reflection techniques for gathering eye movement data is not new, innovative modifications had to be developed to permit accurate data collection in this flight environment. This study reports on these techniques, modifications, and applications. Author (GRA)

N77-31791# Hughes Aircraft Co., Culver City, Calif. Display Systems and Human Factors Dept.
CREW SIZE EVALUATION FOR TACTICAL ALL-WEATHER STRIKE AIRCRAFT Final Technical Report
M. L. Hershberger, L. A. Scanlan, and D. W. Craig Wright-Patterson AFB, Ohio AFAL Apr. 1977 88 p refs
(Contract F33615-75-C-1126)
(AD-A041675; HAC-D4163; HAC-P76-48R; AFAL-TR-76-79) Avail: NTIS HC A05/MF A01 CSCL 05/9

This research and development obtained significant information necessary to assess the requirements for one- versus two-man aircraft in air-to-ground strike missions using synthetic aperture radar (SAR). A real-time man-in-the-loop simulation was conducted in which one- and two-man TAC crews performed aircraft flight control, aircraft systems management, communications, threat detection, countermeasures, and SAR target acquisition tasks. Threat detection and response tasks were employed to vary crew workload and to create inside-cockpit and outside-cockpit visual tasks. A shallow interdiction air-to-ground strike mission with ingress to enemy territory, penetration of enemy territory, and SAR tactical target acquisition phases were simulated. One and two-man aircrew flight control performance, threat detection and response, and SAR target acquisition performance were measured. In general, two-man crews were superior to one-man crews at aircraft flight control, outside-cockpit threat detection, and SAR target acquisition tasks. The dominant superiority of two-man crews, however, was for outside-cockpit threat detection. A major advantage for a two-place SAR air-to-ground strike aircraft, therefore, is the improved visual surveillance achieved with two crewmen and the resulting increased survivability when over hostile enemy territory. The detailed simulation procedures and results of this work and the implications to advanced synthetic aperture radar airborne strike systems are discussed in the report. GRA

N77-31792# Navy Experimental Diving Unit, Panama City, Fla.
EVALUATION OF JIM: A ONE-ATMOSPHERE DIVING SUIT Final Report
Robert C. Carter, Jr. Jul. 1976 17 p
(AD-A039608; NEDU-5-76) Avail: NTIS HC A02/MF A01 CSCL 06/17

The atmospheric diving suit (ADS) 'JIM' was evaluated at the Navy Experimental Diving Unit during a two-week period in June, 1975. The suit was shown to meet many of the expectations that the manufacturer had for it. It could keep an aquanaut dry at one atmosphere while he worked in water to depths of 1000 FSW. GRA

N77-31793# Naval Weapons Center, China Lake, Calif.
EXPERIMENTS WITH COLOR CODING ON TELEVISION Cockpit Instrumentation Study Report, Feb. - Oct. 1976
Jan. 1977 23 p refs
(AD-A040415; NWC-TP-5952) Avail: NTIS HC A02/MF A01 CSCL 01/4

Three experiments were conducted to investigate the effectiveness of color in a potential cockpit application. The experiments measured the subjects ability to monitor random malfunction indications, shown in either color-coded, single color, or black-and-white conditions on simulated engine management displays. The subjects were simultaneously engaged in a dynamic target detection task on an adjacent display during the monitoring task. Ambient illumination color and subject experience were additional variables. The results show that response time on the

target detection task was faster when the engine display was color-coded than when it was black-and-white. Time to report malfunctions was slower with red or green monochrome displays than with the other colors. The response time in reporting malfunctions on the black-and-white display was not affected by the choice of color on the adjacent display. Finally, performance on target detection and malfunction reporting was not affected by ambient illumination or the experience of the subjects.

Author (GRA)

N77-31794# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

A COMPARATIVE EVALUATION OF THE APH-6D, HGU-35/P (LOW PRESSURE), HGU-35/P (HIGH PRESSURE), VTAS 2 AND VTAS 3 HELMET SYSTEMS ON THE DYNAMIC FLIGHT SIMULATOR

Robert Z. Snyder 30 Dec. 1976 67 p

(AD-A040927; NADC-75195-40) Avail: NTIS HC A04/MF A01 CSCL 15/5

Pilots flying high performance aircraft under sustained acceleration in an ACM (Air Combat Maneuver) have been exposed to an additional stress imposed upon them by their heavy, unstable helmet and its related oxygen mask. A newly developed lightweight mold-in-place helmet with an integrated oxygen mask system was dynamically tested on the Naval Air Development Center (NAVAIRDEVCEN) human centrifuge in a simulated ACM acceleration profile. Four pilots, each wearing three variations of the prototype helmet, were exposed to a peak of 6 Gz in 10 seconds, held for approximately 4 seconds, returned to 2 Gz, then built up to 4 Gz in 10 seconds, held for approximately 4 seconds and then returned to a plateau of either 3 Gz or 1 Gz for a total time of 4 minutes. Performance measurements were made during the plateaus. The pilots used the APH-6 single visor helmet as a standard for the conventional HGU-35/P helmet and a VTAS-II helmet (lightweight, mold-in-place helmet assembly using an A-13A oxygen mask and an add-on VTAS electronic/optical system) as a standard of comparison for the VTAS-III (an HGU-35/P integrated oxygen mask system and an integrated VTAS electronic/optical system). Based upon a perfect score of 100, the overall evaluation of the helmets tested scored as follows: APH-6 (57.5), VTAS-II (46), HGU-35P High Pressure (79), HGU-35 Low Pressure (77.5), and the VTAS-III (71).

Author (GRA)

N77-31795# Naval Postgraduate School, Monterey, Calif.

METHODOLOGY FOR IDENTIFYING AND QUANTIFYING THE CRITICALITY OF HUMAN FACTORS DEFICIENCIES IN NAVAL AIRCRAFT COCKPITS M.S. Thesis

James Francis Mowbray Mar. 1977 134 p refs

(AD-A040201) Avail: NTIS HC A07/MF A01 CSCL 05/5

Human factors and system safety engineering concepts frequently have not been incorporated in the design of U.S. Navy aircraft cockpits. The relationship of human factors cockpit deficiencies to pilot error and operator inefficiency is examined and the need for a comprehensive data base of these deficiencies is demonstrated. A questionnaire was designed and developed to collect the required data from the operators of naval aircraft. Results from administering the questionnaire to a number of subjects substantiate the validity of the method for gathering the human factors deficiency data. Recommendations are made for expanding the data collection to a Navy-wide basis.

Author (GRA)

N77-31796# Perceptronics, Inc., Woodland Hills, Calif.

MAN-MACHINE COMMUNICATION IN COMPUTER-AIDED REMOTE MANIPULATION Technical Report, 2 Feb. 1976 - 1 Feb. 1977

Barry L. Berson, William H. Crooks, Efraim Shaket, and Gerson Weltman 1 Mar. 1977 120 p refs

(Contract N00014-76-C-0603)

(AD-A040217; PATR-1034-77-3/1) Avail: NTIS HC A06/MF A01 CSCL 05/8

Automated Remote Manipulation is both an area of great practical utility for Navy Undersea Operations, and a prime example of new type of man-machine interaction in which the human operator must supervise and control a complex and adaptive man-computer system. This report presents the results of an experimental study focusing on man-machine communication with computer-aided manipulators. This report describes (1) underwater manipulator functions and operator performance requirements in remote manipulation, (2) the development of a theoretical man-machine communication model based on procedural sets, and (3) an experimental investigation on the effect of several elementary computer aiding techniques on the ability of trained operators to perform selected remote manipulation tasks. The results of the experimental investigation indicated that computer aiding can significantly decrease task performance times for a number of remote manipulation tasks. Computer aiding in the form of resolved motion and automated control significantly reduced the times required to perform valve turning and ring manipulation tasks. The results also indicated that if higher-level aiding schemes are to be effective in terms of improving man-machine performance, the design of the communications language and interface must be carefully designed to maintain the communication goals of naturalness, simplicity and understandability.

Author (GRA)

N77-31797# Dayton Univ. Research Inst., Ohio. Research Inst.

BIOMECHANICS AND ANTHROPOMETRY FOR COCKPIT AND EQUIPMENT DESIGN Final Report, 1 Dec. 1975 - 31 Dec. 1976

Susan M. Evans, Martin Himes, and Paul E. Kikta Mar. 1976 92 p refs

(Contract F33615-75-C-5092)

(AD-A037020; UDRI-TR-76-85; AMRL-TR-77-7) Avail: NTIS HC A05/MF A01 CSCL 06/14

This report describes enhancements made to the AMRL COMBIMAN (COMputerized BIOmechanical MAN-model) program in the areas of man-model link-system and enfleshment characteristics, and in the area of additional functions or options made available to the user of the interactive graphics computer program of COMBIMAN. These new functions include obtaining hard-copy plots of the man-model and workstation as displayed on the Cathode Ray Tube (CRT), and obtaining visibility plots of the workstation boundary. The report also documents technical procedures followed in readying the AMRL HERCULES (Human Engineering Research to Cull Efficient Strength) Lab for measuring strength capabilities of seated operators, and the procedures established for running the subjects and gathering the data. The last area covered in this report is the development of programs and the manipulation of anthropometric data used in the analysis of human size variability data.

GRA

N77-31798# Pennsylvania State Univ., State College. Environmental Acoustics Lab.

A REAL-EAR FIELD METHOD FOR THE MEASUREMENT OF THE NOISE ATTENUATION OF INSERT-TYPE HEARING PROTECTORS

P. L. Michael, R. L. Kerlin, G. R. Bienvenue, J. H. Prout, and J. I. Shampan Jun. 1976 171 p refs

(Contract CDC-99-74-63)

(PB-267419/0; DHEW/PUB/NIOSH-76/181; NIOSH-76/181) Avail: NTIS HC A08/MF A01 CSCL 06Q

A method is developed for measuring the real-ear noise attenuation of insert-type hearing protectives worn in work places. The method involves the use of a circumaural headphone set comprising a muff-type hearing protector fitted with earphone drivers, tested and used to measure noise attenuation for five models of insert-type hearing protectors. Statistical analysis shows strong correlations between the attenuation data measured by the field method and standard-method procedures for all nine one-third-octave-band test signals. General recommendations of a measurement procedure are given for the field method. The method is intended primarily as a technique for documenting the variability of hearing protector performance in the work place.

GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-31799 Northwestern Univ., Evanston, Ill.
SECONDARY INDEXES AS ACCESS MODELS FOR RELATIONAL DATA BASE SYSTEMS Ph.D. Thesis
Ann Sigman Michaels 1976 311 p
Avail: Univ. Microfilms Order No. 77-10068

An access path model, which uses a multi-attribute secondary index as the access path structure, is introduced and an analytical performance study is conducted. It is compared with an inverted list access structure and with an unindexed relation. The multi-attribute index is associated with a partitioned storage structure for relations. In the cases of the inverted list and the unindexed relation, tuples were not assumed to be stored according to any particular organization. The unindexed relation was assumed to have no associated access structure. The multi-attribute index with its associated relation storage structure seems to produce the best overall performance. The evaluation time for data base transactions is generally comparable to or less than it is for the other two approaches, and this index requires less storage space than the inverted list index.
Dissert. Abstr.

N77-31800*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
AN INTERLEAVING DEVICE Patent Application
James R. Fischer, inventor (to NASA) Filed 2 Sep. 1977 29 p
(NASA-Case-GSC-12111-2; US-Patent-Appl-SN-830272) Avail: NTIS HC A03/MF A01 CSCL 09B

An interleaving device for processing energy signals between various logic devices comprises a first plurality of spaced energy carrying layer materials, each with a plurality of juxtaposed conduits for passing energy signals therethrough. Every conduit has a longitudinal axis substantially parallel to a diagonal of each of the first layers. A second plurality of energy carrying materials arranged between adjacent ones of the spaced first layer materials, also, has a plurality of juxtaposed conduits for passing the energy signals therethrough. Each of the conduits in the second layer has a longitudinal axis substantially parallel to a diagonal of each of the second layer materials and substantially perpendicular to the axes of the conduits of the first layer materials.
NASA

N77-31801# Naval Research Lab., Washington, D. C.
A GENERAL PURPOSE MINI-COMPUTER BASED DIGITAL Interim Report
Theo W. Hodge and Anita P. Skelton May 1977 34 p
(XF12151006)
(AD-A041000; NRL-MR-3502) Avail: NTIS HC A03/MF A01 CSCL 09/2

The general design approach of hardware and software systems and the present performance capability of a digital signal processing laboratory is given. Block diagrams of the hardware and software systems are provided along with an example of a recent task.
Author (GRA)

N77-31802# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
DYNAMIC MEMORY ALLOCATION FOR A VIRTUAL MEMORY COMPUTER Ph.D. Thesis
Robert Lucius Budzinski Jan. 1977 150 p refs
(Contract DAAB07-72-C-0259; Grant NSF MCS-73-03488)
(AD-A040763; R-754; UILU-ENG-77-2201) Avail: NTIS HC A07/MF A01 CSCL 09/2

A virtual memory is a hierarchical or multi-level memory with an address mapping mechanism and an allocation algorithm. The first level of the hierarchy is the primary memory. The primary memory has the highest speed and smallest capacity in the hierarchy. Subsequent levels have decreasing speed and increasing storage capacity. The addressing mechanism maps a program's address space into the physical memory space. The address space of the program can be much larger than the available capacity of the primary memory. For this thesis, a page-oriented addressing mechanism was employed. A page is a fixed size block of computer words associated with contiguous memory addresses. The allocation algorithm manages the flow of pages to and from the primary memory.
GRA

N77-31803# North Carolina State Univ., Raleigh. Signal Processing Lab.
COMPUTER VISION USING ENCODED STEREO IMAGES
J. N. England Jan. 1977 10 p refs
(Contract DAAG29-76-G-0133)
(AD-A040196; SPL-18; ARO-13989.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The methods of depth determination used in scene analysis are discussed. Previous schemes incorporating a single view of the scene are reviewed. These include methods requiring a special illumination source. A review of the work using two (stereoscopic) images is presented. Finally, a method for extracting objects from a pair of run length coded images is developed. The procedure relies on feature extraction and correllation techniques developed specifically for operation on objects in run length coded images.
Author (GRA)

N77-31804# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
RANDOM ACCESS MEMORY FAULT LOCATION CAPABILITY OF THE ALGORITHM TEST SEQUENCE Final Technical Report, Jun. - Oct. 1976
John Knaizuk, Jr. and C. R. P. Hartmann Griffiss AFB, N. Y. RADC May 1977 41 p refs
(Contract F30602-71-C-0312)
(AD-A040159; TR-76-10; RADC-TR-77-150) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes an Algorithm Test Sequence (ATS) designed to provide an optimal test sequence for detecting stuck-at faults in a random access memory. An analysis of its capability to locate any single stuck-at fault is provided.
Author (GRA)

N77-31805# RAND Corp., Santa Monica, Calif.
IMPLICATIONS OF MODERN COMPUTER DISPLAY TECHNOLOGY Final Report
I. E. Sutherland Sep. 1976 19 p
(Contract N00014-75-C-1030)
(AD-A041044; WN-9605-ONR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Advances in computing have come from improvements in integrated circuits and improvements in our ability to produce complex software systems. Display technology has reached the point where it is possible to display almost anything the human mind can conceive. Installation of complex computing machines changes the nature of the organization it serves, thus it is difficult to establish in advance clear specifications. The increasing complexity of computing equipment will ultimately force a change

in Navy procurement procedures. Operating units of the Fleet will have to be given greater control over the specification and modification of the equipment they operate. Careful consideration needs to be given to how the specifications for complex computing devices are written, and those who use the devices need to have a say in the process. GRA

N77-31806# Science Applications, Inc., McLean, Va.
ADVANCED SIGNAL PROCESSING SOFTWARE VERIFICATION AND VALIDATION Final Report
1976 42 p refs
(Contract N00014-75-C-0656)
(AD-A040956) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Computer Family Architecture Project has as its stated mission the selection of a commercially available computer architecture that would provide the basis for a family of military computers in the 1980's. In order to make a valid selection, the parent project gave birth to sibling efforts involving the design, development, verification, and validation of (1) an Architecture Research Facility (ARF) and (2) a set of candidate architecture benchmark test programs. A computer architecture can be described on the ARF using the instruction Set Processor Language (ISPL) for which the ARF has a compiler. Using the simulation capabilities of the ARF, the benchmark test programs were to indicate the performance characteristics of the candidate computer architectures in a quantifiable manner. The CFA selection committe could then select the best architecture based on quantitatively justifiable figures of merit derived from evaluating benchmark performance on the ARF simulator corresponding to each of the particular architecture descriptions. The ARF approach provided a controlled environment in which to effectively execute a comparative study of computer architectures at the instruction set level. GRA

N77-31807# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MAN-MACHINE DESIGN CONSIDERATIONS IN SATELLITE DATA MANAGEMENT Technical Report, Mar. - Oct. 1976
Billy M. Crawford, Donald A. Topmiller, and George A. Kuck Apr. 1977 25 p refs
(AD-A041287; AMRL-TR-77-13) Avail: NTIS HC A02/MF A01 CSCL 05/8

The report is divided into three sections: Section I is an introduction to human information processing theory with implications of the human information processing capacity and limitations for the Satellite Data Management (SDM) 'User Pipe'; Section II incorporates two subsections dealing with man/computer relationships and computer decision aiding techniques: no attempt is made to specify specific design considerations for SDM--only implications can be inferred; Section III is an attempt to relate the first two general sections to some of the anticipated conceptual design issues for Satellite Data Management. Author (GRA)

N77-31808# Computer Sciences Corp., Falls Church, Va.
A COMPREHENSIVE DATA BASE ACCESS METHODOLOGIES DESIGN GUIDE Final Report
John Emory, Sally Green, Robert Grimes, Otis Haslop, and Anupam Shah 28 Sep. 1976 331 p refs
(Contract DCA100-75-C-0029)
(AD-A041459; CSC-R493700019-2-2; CCTC-TM-123-76) Avail: NTIS CSCL 09/2

The Comprehensive Data Base Access Methodologies Design Guide is produced to assist programmers, analysts, and data base managers in the application of state-of-the-art methodology in the use and design of data structures, access mechanisms, and management of computer processed data. The scope of the document covers the principal methods in general use today. The material has been organized for easy comprehension by relatively inexperienced personnel and provides a source for further perusal of related literature. Author (GRA)

N77-31809# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER. VALIDATION SUMMARY REPORT
30 Jun. 1977 80 p

This Validation Summary Report (VSR) for the IBM 370 COBOL Compiler Version 2 Mod O (MVS Version 3.7 VS2) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-19 74/FIPS PUB 21-1). The Compiler was validated at the High level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-19 74, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. Author (GRA)

N77-31810# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER VALIDATION SUMMARY REPORT
30 Jun. 1977 75 p
(AD-A041322; CCVS74-VSR235) Avail: NTIS HC A04/MF A01 CSCL 09/2

This Validation Summary Report (VSR) for the Honeywell Series 60 Level 66 COBOL Compiler Version CB3.0 (GCOS Release Version 3I) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the High level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N77-31811# Defense Documentation Center, Alexandria, Va.
SOURCE HEADER LIST Technical Report for period ending 20 Apr. 1977
Jun. 1977 800 p Supersedes DDC/TR-76/2
(AD-A041700; DDC/TR-77/2; DDC/TR-76/2) Avail: NTIS HC A99/MF A01 CSCL 05/2

Source names used by the Defense Documentation Center in the Research and Technology Work Unit Information System, and the Technical Report, Program Planning, and Independent Research and Development Data Banks are compiled alphabetically. Each of the 24,947 source names is assigned a 6-digit numeric code for computer input and retrieval, a 4-digit alphanumeric geopolitical code and a 1-digit alphanumeric type code. Author (GRA)

N77-31812# Defense Systems Management School, Fort Belvoir, Va.
INTERACTIVE COMPUTER GRAPHICS: A RESPONSIVE PLANNING AND CONTROL TOOL FOR DoD PROGRAM MANAGEMENT
Joseph E. Callahan, Carlton F. Roberson, and George H. Perino, Jr. Jan. 1977 56 p refs
(AD-A041798; DSMC-RR-77.1) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report summarizes the methodology, conduct and findings of the Defense Systems Management College (DSMC) research study of Interactive Computer Graphics (ICG) as a tool for program management planning and control. The study was conducted in four phases to meet four objectives: to determine the feasibility of representing and interrogating a program/project network on a graphics console; to determine the feasibility of developing an Interactive Computer Graphics Networking System (ICGNS) software prototype for program management planning and control; to examine the affordability of implementing an ICGNS in the PMO; and to assess the state-of-the-art in industry and DOD regarding existing and/or proposed ICG managerial applications. GRA

N77-31813# Logistics Management Inst., Washington, D. C.
DATA MANAGEMENT SYSTEMS ANALYSIS: FINDINGS AND RECOMMENDATIONS Final Task 3 Report
Robert K. Wood and Craig A. Webster Jun. 1977 66 p
(Contract SD-321)

The Office of Economic Adjustment (OEA) within the Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics (ASD(MRA and L)) serves as the staff arm of the President's Interagency Economic Adjustment Committee (EAC). The office is responsible for organizing and coordinating the Federal government's response to communities affected by Defense base closures, reductions, or buildups. The Logistics Management Institute (LMI) has a contract with OEA under Task Order SD-321-57 Revised (LMI Task 76-16) with two principal objectives: (1) to design a data management system that would allow OEA to respond rapidly to inquiries from the White House, Congress, State Governors and the press, as well as to improve internal management of project activities; and (2) to develop a project management manual to be used by OEA Project Managers and Regional Directors in carrying out their economic adjustment function. The study is divided into four tasks. Tasks 1 and 2 are to conduct a preliminary review of current OEA activities and reporting requirements and prepare a work plan. Task 3 is to design a data management system for OEA, specify requirements for alternative processing concepts, specify and evaluate the alternatives and recommend a preferred concept; Task 3A is to develop a project management manual. Task 4 is to develop system specifications necessary for OEA to proceed with the implementation of the data management system. GRA

N77-31814# Brookhaven National Lab., Upton, N. Y.
ENERGY MODEL DATA BASE (EMDB) USING SYSTEM 2000
P. H. Newhouse Sep. 1976 22 p Presented at Assoc. of System 2000 Users for Tech. Exchange Meeting Toronto, 29 Sep. 1976
(Contract E(30-1)-16)
(BNL-21854; Conf-760989-1) Avail: NTIS HC A02/MF A01

The Energy Model Data Base (EMDB) at BNL is discussed. It contains high-quality, documented numeric data describing the technological processes which comprise the United States Energy System. The EMDB was designed as a collection of energy data to be used in an array of energy systems modeling tasks. The history and use of the EMDB are explained in a nontechnical way. ERA

N77-31815# Oak Ridge National Lab., Tenn.
NDT-COMP8 MICROCOMPUTER
C. V. Dodd Mar. 1977 25 p
(Contract W-7405-eng-26)
(ORNL/TM-5773) Avail: NTIS HC A02/MF A01

An 8080-based microcomputer, the NDT-COMP8, was developed for control and data reduction of nondestructive tests. The computer is on a single 9.35 in. by 6.2 in. printed circuit board, and has up to 4 K of ROM (read only memory), 4 K of RAM (random access memory), 1 serial I/O port (that can be jumpered for TTL, RS232C, or 20 ma current loop, with baud rates from 75 Hz to 4800 Hz), and 72 parallel I/O ports. A monitor for program development, a floating-point math package, and a PROM simulator/programer were developed to aid in the application of the board. ERA

N77-31816# Integrated Sciences Corp., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF SKETCH MODEL ACCURACY AND USEFULNESS IN A SIMULATED TACTICAL DECISION AIDING TASK
Gary W. Irving, Jennifer J. Horinek, Pak Y. Chan, and David H. Walsh May 1977 179 p refs
(Contract N00014-75-C-0811)
(AD-A039853; ISC-215-3) Avail: NTIS HC A09/MF A01 CSCL 12/2

This report describes the implementation and experimental evaluation of a proposed decision aid to support naval Task Force Commanders. The decision aid, named the Sketch Model, enables a human operator to specify his subjective estimate of a multidimensional, multimodal, unsymmetric three dimensional function by electronically sketching its two-dimensional projection (e.g., iso-altitude contours of a three dimensional function) on a computer graphics terminal. The Sketch Model is hypothesized to have certain advantages over comparable decision aiding techniques (such as theoretical and empirical objective modeling and scalar subjective judgment). These advantages include ease, speed, and accuracy of estimation and of updating; consideration of qualitative data; and the capability of Bayesian estimation without explicit a priori data. GRA

N77-31817# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
TEKTRONIX PICTURES USING NOVA BASIC
Gregg E. Marshall and Richard H. Winkler Mar. 1977 35 p
(PB-267422/4; NOAA-TM-ERL-AL-8; NOAA-77042006) Avail: NTIS HC A03/MF A01 CSCL 09B

The use of a simple computer graphics extension to basic is described. The extension, written as machine language subroutines, provides facilities for using the features of Tektronix 4014 graphics terminals with enhanced graphics modules. The graphics package was successfully implemented on a number of NOVA systems with Tektronix 4010 and 4014 terminals. GRA

N77-31818# Stanford Univ., Calif. Electronics Labs.
PERFORMANCE BOUNDS FOR PARALLEL PROCESSORS
Ruby Bei-loh Lee Nov. 1976 45 p refs
(Contract N00014-75-C-0601)
(AD-A040873; SU-SEL-77-002; TR-125) Avail: NTIS HC A03/MF A01 CSCL 12/1

A general model of computation on a p-parallel processor is proposed, distinguishing clearly between the logical parallelism (p* processes) inherent in a computation, and the physical parallelism (p processor) available in the computer organization. This shows the dependence of performance bounds on both the computation being executed and the computer architecture. GRA

N77-31819# Proprietary Software Systems, Inc., Beverly Hills, Calif.
COMPILER ACCEPTANCE CRITERIA GUIDEBOOK
Joel Fleiss, Guy Phillips, and Angel Alvarez May 1977 155 p refs
(Contract F30602-76-C-0229)
(AD-A040595; RADC-TR-77-148) HC A08/MF A01 CSCL 09/2

PSS has composed a set of criteria that may be used to provide guidance in the procurement of compilers. These guidelines are presented in tutorial form to provide a useful tool to the individual who does not have experience in the specific area of compilers. The guidelines contain a check list of items that should be considered in the specification of a compiler and the acceptance and testing of that compiler. Examples and sample forms are provided to demonstrate the use of the guidelines described in the report. Author (GRA)

N77-31820# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
TOWARD THE DEVELOPMENT OF A DATA TRANSLATION METHODOLOGY AND SELECTION OF TARGET DATABASE STRUCTURES Final Report, 1 Jan. 1976 - 28 Feb. 1977
James P. Fry and Alan G. Merten Feb. 1977 24 p refs
(Grant AF-AFOSR-2975-76)
(AD-A041715; AFOSR-77-0792TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Progress has been made toward development of a data translation methodology and selection of optimal target databases at the University of Michigan. A model for implementing data translators has been formulated and verified through the development of a series of increasingly general data translators. Mechanisms have been developed for prescribing logical data transformations--- Restructuring Specifications--and physical data descriptions---a Stored-Data Definition Language. Finally, results have been obtained on the evaluation, selection, and optimization of target database structures. Author (GRA)

N77-31821# Naval Research Lab., Washington, D. C.
TESTS OF RANDOM NUMBER GENERATORS FOR THE ASC Interim Report
B. T. Caruthers and G. H. Herling May 1977 35 p refs
(AD-A041732; NRL-MR-3509) Avail: NTIS HC A03/MF A01 CSCL 09/2

A scalar random number generator, RANDUL, and a vector random number generator, VRANF, are available on the ASC at NRL. Several tests to which they have been subjected are described, and the results indicate that both are generally acceptable for most applications. Author (GRA)

N77-31822# Rochester Univ., N. Y. Graduate School of Management.
ECONOMICS OF MANAGEMENT OF UNIVERSITY COMPUTING RESOURCES Final Report
Michael C. Jensen Apr. 1977 59 p
(Grant NSF-NM-44241)
(PB-267107/1) Avail: NTIS HC A04/MF A01 CSCL 09B

The study focuses primarily on the budgeting, pricing, and organizational aspects of the problems and emphasizes the application of economics to their understanding and solution. The basic assumption underlying the approach taken in this report is that most of the major problems associated with the management of computing resources are 'organizational' or human problems. In solving them it is important to strive for the creation of a combination of pricing, budgeting, evaluation, and other organizational policies which create a system which contains strong incentives for people to make changes which are generally in the 'right' direction. To do so such a system must provide strong incentives for people to economize on the use of scarce resources. GRA

N77-31823# California Univ., Berkeley. Dept. of Chemistry.
LARGE SCALE SCIENTIFIC COMPUTATION VIA MINICOMPUTER Final Report, 1973-1976
William H. Miller Sep. 1976 100 p refs
(Grant NSF GP-39317)
(PB-267575/9) Avail: NTIS HC A05/MF A01 CSCL 07D

A program of research designed to test the suitability of minicomputers for large scale scientific computations is described. The problems attacked are those traditionally done on the largest and fastest commercially available electronic computers: the calculation of potential energy surfaces and the subsequent evaluation of the dynamics of chemical reactions. Cost effectiveness, practical limitations and advantages, and implications of their experience for present and future large scale scientific computations are discussed, not only for minicomputers but also for large computers. GRA

N77-31824# Bureau of Mines, Pittsburgh, Pa. Eastern Field Operation Center.
COMPUTER GRAPHICS DEMONSTRATION: AREA COAL AVAILABILITY STUDIES
John R. Bitler and John D. Martin 1977 22 p refs
(PB-267923/1; BM-IC-8736) Avail: NTIS HC A02/MF A01 CSCL 08I

A computerized mapping system was developed by the Bureau of Mines to provide procedures for the rapid and inexpensive display of coal reserve data. Mapping system output consists of two types of maps, point distribution and contour (isopleth), which can be produced for data (coal analyses) associated with a point location (outcrop, drill core, or mine samples). The primary advantage of this system is that it enables the display of a rapidly changing data base and computerized map generation without the intermediate steps of digitizing and overlaying to produce base maps. The mapping system is applicable to any regional mineral reserve or resource study for which point location data are available. Included are example maps of the distribution of data points and contouring for sulfur content of the Upper Freeport coalbed in the western Pennsylvania demonstration area. GRA

N77-31825# National Bureau of Standards, Washington, D. C. Information Technology Div.
COMPUTER SCIENCE AND TECHNOLOGY. COMPUTERS IN THE FEDERAL GOVERNMENT: A COMPILATION OF STATISTICS
Martha M. Gray Jun. 1977 45 p refs
(PB-267607/0; NBS-SP-500-7; LC-77-608102) Avail: NTIS HC A03/MF A01 CSCL 09B

Data on the status of computer technology in the Federal Government are compiled. This compilation is a combination of existing statistics from Federal Government and computer industry sources, and original statistics based on these sources. Information is included on numbers of computers installed in the Federal Government, dollar value of computers installed, numbers of computers installed by agency, and Federal ADP costs by agency and minicomputers in the Federal Government. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-31826 California Univ., Los Angeles.
VERIFICATION OF MICROPROGRAMS Ph.D. Thesis
David Andrew Patterson 1976 308 p
Avail: Univ. Microfilms Order No. 77-9352

High level language programming, structured programming and formal program verification were combined to produce correct, efficient microprograms. A structured, high level microprogramming language was designed. An optimizing compiler was created that produces microprograms for a horizontally microprogrammable computer. A verification condition generator and algebraic simplifier were created to aid the formal verification of microprograms. A real computer was emulated using structured programming and high level microprogramming. This microprogram was formally verified and exhaustively tested using hardware diagnostic routines. Dissert. Abstr.

N77-31827*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DIGITAL OVERLAYING OF THE UNIVERSAL TRANSVERSE MERCATOR GRID WITH LANDSAT DATA DERIVED PRODUCTS
Marcellus H. Graham (NASA, Earth Resources Labs., Slidell, La.) Sep. 1977 45 p refs
(NASA-TM-58200) Avail: NTIS HC A03/MF A01 CSCL 09B

Picture elements of data from the LANDSAT multispectral scanner are correlated with the univesal tranverse Mercator grid. In the procedure, a series of computer modules was used to make approximations of universal transverse Mercator grid locations for all picture elements from the grid locations of a limited number of known control points and to provide display and digital storage of the data. The software has been written in FORTRAN 4 language for a Varian 70-series computer. Author

N77-31828# Sperry Univac, St. Paul, Minn. Defense Systems Div.
MODERN PROGRAMMING PRACTICES STUDY REPORT Final Technical Report, Jan. 1976 - Jan. 1977
W. E. Branning, D. M. Willson, J. S. Schaenzer, and W. A. Erickson Apr. 1977 443 p refs
(Contract F30602-76-C-0136)
(AD-A040049; PX-11932-F; RADC-TR-77-106) Avail: NTIS HC A19/MF A01 CSCL 09/2

This technical report and report summary show that for the surveyed program developments: (a) Top-down program development reduced cost by 15%. (b) Regardless of the method for development used labor was generally distributed as follows: (1) 10% for analysis, (2) 30% for design, (3) 35% for coding and debugging, (4) 25% for testing. (c) Program testing was automated using real-time on-line simulation, scenario control, data recording and reduction. (d) Software quality assurance and configuration management were formal disciplines. (e) Through system design, operating system software provided real-time on-line casualty recovery of system functions from hardware failures. (f) Through system design, operating system software allowed for on-line maintenance testing of hardware equipments while continuing real-time operation. (g) Software tools found effective on the surveyed programs were described and evaluated. Author (GRA)

N77-31829# TRW Defense and Space Systems Group, Redondo Beach, Calif.
IMPACT OF MPP ON SYSTEM DEVELOPMENT Final Technical Report, Dec. 1975 - Jan. 1977
John R. Brown Griffiss AFB, N.Y. RADC May 1977 211 p refs
(Contract F30602-76-C-0095; AF Proj. 5581)
(AD-A040467; TRW-29115-6001-RU00; RADC-TR-77-121)
Avail: NTIS HC A10/MF A01 CSCL 09/2

This document presents the results of an evaluation of the impact of modern programming practices (MPP) applied to TRW's Ballistic Missile Defense (BMD) Systems Technology Program

(STP) Software development. The report provides an overview of STP including a reconstructed chronology of significant events and a description of the STP software development environment. It also presents detailed results of: identification, selection and definition of appropriate STP practices to be evaluated; investigation of the impact of selected MPP on software development cost, schedule and quality; as well as definition and preliminary application of techniques and tools comprising methodology for comparing TRW practices with those used by other contractors on other projects. Author (GRA)

N77-31830# Texas Univ., Austin. Center for Cybernetic Studies.
IMPROVED COMPUTER-BASED PLANNING TECHNIQUES
Fred Glover, John Hultz, and Darwin Klingman Feb. 1977 54 p refs
(Contracts N00014-75-C-0616; N00014-76-C-0383)
(AD-A040592; CCS-283) Avail: NTIS HC A04/MF A01 CSCL 09/2

Management Science has responded recently to the needs of practitioners by contributing two new technologies. These are network computer implementation technology and NETFORM (network formulation) technology. In this paper we show how these new technologies have been used to model and solve real-world problems. In addition, we attempt to give the practitioner insights into how these important policy evaluation tools may be applied to his unique management problems. Author (GRA)

N77-31831# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A GENERAL-PURPOSE CROSS-ASSEMBLER FOR PRODUCING ABSOLUTE BINARY OBJECT CODE
Paul R. Kretz 6 Apr. 1977 75 p refs
(Contract F19628-76-C-0002; AF Proj. 2027)
(AD-A040553; TN-1977-20; ESD-TR-77-72) Avail: NTIS HC A04/MF A01 CSCL 09/2

A general-purpose cross-assembler is described. The cross-assembler, written in PL/I, has been implemented on an IBM 370/168 using the time-sharing Conversational Monitor System (CMS). Absolute binary object code will be produced. Although the cross-assembler has been designed with the intention of assembling code for various microprogrammable machines, even code for conventional minicomputers has been assembled. Use of the cross-assembler is discussed assuming a CMS environment. Included are the disk-resident files to facilitate an assembly. Various pseudo-ops, or assembler control statements, are used to describe the machine for which an assembly is done. An example of using the cross-assembler for a parallel microprogrammable digital signal processor (PMP-I) is discussed. Author (GRA)

N77-31832# General Research Corp., Santa Barbara, Calif.
JAVS TECHNICAL REPORT. METHODOLOGY REPORT Final Report, May - Dec. 1976
N. B. Brooks and C. Gannon Apr. 1977 94 p refs
(Contract F30602-76-C-0233; AF Proj. 5550)
(AD-A041048; RADC-TR-77-126-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 09/2

The JOVIAL Automated Verification System (JAVS) is a tool for analyzing source programs written in the J3 dialect of the JOVIAL language. From the user's viewpoint, JAVS consists of a sequence of processing steps which (1) analyze his JOVIAL source text, (2) guide him in preparing test cases for his programs, (3) analyze the results of tests executed by his programs, and (4) automatically document his programs. This report describes the application of a testing methodology utilizing an Automated Verification System (AVS) such as JAVS. Sections of this report present an overview of the testing methodology and the capabilities of JAVS and describe actual testing experience with JAVS, the general role of an AVS in applying the testing methodology, practical techniques for particular test situations, and expanded capabilities for advanced AVS implementations. Author (GRA)

N77-31833# North Carolina State Univ., Raleigh. Signal Processing Lab.
RUN LENGTH CODING FOR IMAGE ANALYSIS
J. N. England Jan. 1977 19 p refs
(Grant DAAG29-76-G-0133)
(AD-A040195; SPL-17; ARO-13989.2-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

Image coding techniques which have proven to be useful for transmission purposes have seldom been applied to image analysis. This report examines the application of one such technique, run-length encoding, to problems in the scene analysis domain. Several operations within a run-length encoded data structure are discussed, including area access, region growing, edge following, and corner identification. Author (GRA)

N77-31834# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
DOCUMENTATION OF CURRENT IDA COMPUTER MATERIAL DEVELOPED FOR OCPA, VOLUME 1
Leo A. Schmidt Jan. 1977 287 p
(Contract DCPA01-76-C-0213)
(AD-A040945; IDA/HQ-77-19225-Vol-1) Avail: NTIS MF A01 CSCL 15/4

This paper is a documentation of computer materials developed by the Institute for Defense Analyses (IDA) for use by the Defense Civil Preparedness Agency (DCPA). All IDA physical data processing materials (IBM cards, magnetic tape, computer printouts) have been surveyed and catalogued. All computer programs are written in FORTRAN (a general knowledge of this language is assumed in the detailed descriptions contained herein). Computer programs considered useful by IDA have been included and documented. A group of general purpose subprograms are described, along with their interfaces with the using programs. Data file formats also have been developed, along with programs for managing these files. Such programs and resulting files are described in detail. Author (GRA)

N77-31835# Stanford Research Inst., Menlo Park, Calif.
A LEMMA DRIVEN AUTOMATIC THEOREM PROVER FOR RECURSIVE FUNCTION THEORY
Robert S. Boyer and J. Strother Moore Jun. 1977 36 p refs
(Contract N00014-75-C-0816; Grant NSF DCR-72-03737; NR Proj. 049-378)
(AD-A041622; SRI-0816-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

The paper describes work in progress on an automatic theorem prover for recursive function theory that is intended to be applied in the analysis (including verification and transformation) of useful computer programs. The mathematical theory of the theorem prover is extendible by the user and serves as a logical basis of program specification (analogous to, say, the predicate calculus). The theorem prover permits no interaction once given a goal, but many aspects of its behavior are influenced by previously proved results. Thus, its performance on difficult theorems can be radically improved by having it first prove relevant lemmas. The theorem prover employs such lemmas in several ways. Among the interesting theorems proved are the correctness of a simple optimizing compiler for expressions and the correctness of a 'big number' addition algorithm. GRA

N77-31836# Applied Psychological Services, Wayne, Pa.
STUDIES AND DESIGN SPECIFICATIONS FOR COMPUTERIZED MEASUREMENT OF TEXTUAL COMPREHENSIBILITY Final Report, Mar. 1975 - Jun. 1976
Arthur I. Siegel, Allan R. Williams, Walter J. Lapinsky, Tom A. Warms, J. Jay Wolf, Steven D. Groff (Air Force Human Resources Lab., Lowry AFB), and James R. Burkett (Air Force Human Resources Lab., Lowry AFB) Oct. 1976 258 p refs
(AF Proj. 1121)
(AD-A041285; AFHRL-TR-76-77) Avail: NTIS HC A12/MF A01 CSCL 05/7

A previous report (AD-A001 537) defined a series of 14 novel measures for determining the comprehensibility of English text on the basis of current psycholinguistic and Structure-of-Intellect oriented concepts. That report not only suggested the potential usefulness of the measures, but also conjectured the feasibility of automating the calculation of these measures. The present report takes the next logical steps in implementing these measures for computer application. First, these measures are analytically defined and described. Then, selected measures are subjected to 'laboratory' experimental investigation using Air Force Manuals, Career Development Course materials, and USAF

Technical Orders as sample texts. Results of these experiments are presented. An automatic calculation method is then developed for each of the 13 selected measures. The structure of the programming specifications is modular and is intended to calculate the measures for variable size blocks of texts. Flow charts and summary descriptions of the program attributes are also presented, together with explanations of run request syntax, sample measures calculations, and output formats. This report then constitutes a complete definition of the program suitable for future implementation on an automatic data processing system. GRA

N77-31837# IBM Watson Research Center, Yorktown Heights, N.Y.
AIDS FOR PROBLEM SOLVING Interim Technical Report
John C. Thomas, Don Lyon, and Lance A. Miller 3 Mar. 1977 45 p
(Contract N00014-72-C-0419)
(AD-A041290; RC-6468) Avail: NTIS HC A03/MF A01 CSCL 05/10

Numerous attempts have been made to provide computerized problem solving aids. In most instances such aids are designed without any previous systematic study of the problem solvers who are to use such an aid or any subsequent validation that such aids are really useful. This paper presents the results of two prelimimary experiments. In one experiment, a structured aid was not found to be an effective aid to problem solving. However, there were indications of how such an aid might be improved. In a second experiment, an unstructured aid was found to facilitate performance on two creative design problems. The results of this experiment also suggest that creative ideas tend to occur in sequences and that subjects are relatively more likely to terminate suggestions with a creative suggestion than an uncreative one. Author (GRA)

N77-31838# Army Missile Research and Development Command, Redstone Arsenal, Ala. Ground Equip/Missile Structures Directorate.
GENERAL CONTOUR PLOTTING PROGRAM FOR HOUSTON INSTRUMENTS OR TEKTRONIX PLOTTERS
Grady E. Patrick, Jr. Apr. 1977 72 p
(AD-A041303; DRDMI-TL-77-5) Avail: NTIS HC A04/MF A01 CSCL 09/2

A generalized computer program has been developed to plot contours on the Houston Instruments and/or Tektronix plotters. Several input options are permitted to increase flexibility of the program. The program is programmed in FORTRAN IV language and implemented on the CDC 6600 computer. Author (GRA)

N77-31839# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
A USERS GUIDE TO THE DATA BUS NETWORK SIMULATOR (DBNS) PROGRAM Final Report, Apr. - Nov. 1976
John E. Camp Apr. 1977 276 p refs
(AF Proj. 2003)
(AD-A041418; AFAL-TR-77-47) Avail: NTIS HC A13/MF A01 CSCL 09/2

This report describes a FORTRAN coded simulator program for predicting waveforms on a data bus network consisting of a main bus with numerous stubs connected via transformer couplers. Bus operation is at baseband with configurations compatible with MIL-STD-1553. The report included program operation, operating instructions and listings of program and data. Sample output plots are included for program verification. Author (GRA)

N77-31840# Naval Research Lab., Washington, D. C.
AN INTRODUCTION TO FORTRAN PROGRAMMING FOR THE ADVANCED SCIENTIFIC COMPUTER
A. K. Jordan and R. H. Long May 1977 20 p refs
(AD-A041070; NRL-MR-3518) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this report is to provide NRL research staff members with a brief, unified introduction to the Advanced Scientific Computer (ASC). It is written from the viewpoint of a research scientist (the user) who knows FORTRAN programming but who is not familiar with the complexities of the ASC and its Job Specification Language (JSL). It is intended to provide the simplest procedures necessary to get on the machine, run FORTRAN programs, and get answers. All of the procedures in this report have been used successfully by the authors. The programming consultants of the Research Computation Center contributed most of the information in this report. They are available to provide more detailed information than is given in this summary. Author (GRA)

N77-31841# General Research Corp., Santa Barbara, Calif.
JAVS FINAL REPORT Technical Report, May 1976 - Jan. 1977
C. Gannon, N. B. Brooks, and W. R. Wisehart Jun. 1977 77 p refs
(Contract F30602-76-C-0233)
(AD-A041237; RADC-TR-77-201) Avail: NTIS HC A05/MF A01 CSCL 09/2

As part of its program to improve software quality and reliability through the implementation of advanced technology, Rome Air Development Center has contracted with General Research Corporation for assistance in using GRC's JOVIAL Automated Verification System (JAVS) to structurally test a large and complex operational program not designed for automated testing. While performing the systematic test, JAVS was evaluated and enhanced, and an applicable testing methodology was developed. This report describes the results of the systematic test, evaluation of JAVS, testing methodology current configuration of JAVS, and proposed capabilities of future tools. JAVS is operational on the HIS 6180 at RADC operating under GCOS, the HIS 6080 at Offutt AFB, Omaha, Nebraska under WWMCCS, and the CDC 6400 at GRC in Santa Barbara, California under the GOLETA Operating System. Author (GRA)

N77-31842# Experimental and Mathematical Physics Consultants, Santa Monica, Calif.
THE MASTER PROGRAM FILE, METHODS AND MODELS Final Report
T. M. Jordan Kirtland AFB, N. Mex. AFWL May 1977 63 p refs
(Contract F29601-75-C-0107; AF Proj. 4695)
(AD-A041943; AFWL-TR-76-197) Avail: NTIS HC A04/MF A01 CSCL 09/2

The MASTER Program File is a collection of subprograms and data libraries used in solving radiation transport problems. This report describes methods and models used in the program. Program capabilities range from 1-dimensional problems through complex geometry, nonlinear, time-dependent problems. Particle physics models include primary and secondary photons, electrons, neutrons and heavy charged particles. Numerical methods include approximate transport kernels, direct numerical integration and MONTE CARLO quadratures. Author (GRA)

N77-31843# General Electric Co., Arlington, Va. Information Systems Programs.
A PRELIMINARY EXPERIMENT TO TEST INFLUENCES ON HUMAN UNDERSTANDING OF SOFTWARE Interim Report
Sylvia B. Sheppard and L. Tom Love 1 Jun. 1977 25 p refs Submitted for publication
(Contract N00014-77-C-0158; NR Proj. 197-037)
(AD-A041916; TR-77-388100-1; Rept-77ISP009) Avail: NTIS HC A02/MF A01 CSCL 05/10

Eight experienced programmers were each given three FORTRAN programs to memorize and reproduce functionally, without notes. Three levels of complexity of control flow and three levels of mnemonic variable names were independently manipulated. The experimental design was an incomplete split-plot factorial where each programmer was given one version of each program and all levels of the two primary independent variables. The participants correctly recalled significantly more statements when the complexity of control flow was reduced. Differences in recall for the three levels of mnemonic variable names were not significant. A further analysis compared the percent of statements correctly recalled to Halstead's E, a measure of the effort required to code a program. The Pearson correlation coefficient was -0.81, over the 24 data points; thus indicating that Halstead's E is a powerful predictor of one's ability to understand a computer program. Several changes in the experimental design and the conduct of the experiment itself are recommended for future experimental work in this area.
Author (GRA)

N77-31844# IBM Federal Systems Div., Whippany, N. J.
SOFTWARE DATA COLLECTION AND ANALYSIS: A REAL-TIME SYSTEM PROJECT HISTORY Final Technical Report, 30 Apr. 1976 - 29 Jan. 1977
W. F. Baker Griffiss AFB, N. Y. RADC Jun. 1977 49 p ref
(Contract F30602-76-C-0161)
(AD-A041644; RADC-TR-77-192) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report discusses the procedures used for, and the results obtained from, an analysis of software error problem reports. The problem reports studied were generated during the development of a large, real-time, highly sophisticated multi-processor data processing system. A brief profile of the development of this system is presented along with discussions of the procedures used in the analysis of the problem reports and the objectives to be met. The results of the analysis are discussed, and statistics reflecting the results are presented. Finally, some of the problems encountered during the course of the study are presented, as well as some pertinent observations. Author (GRA)

N77-31845# IBM Federal Systems Div., Gaithersburg, Md.
AN APPLICATION OF FORMAL INSPECTIONS TO TOP-DOWN STRUCTURED PROGRAM DEVELOPMENT Final Technical Report
Matthew P. Perriens Jun. 1977 77 p refs
(Contract F30602-76-C-0166)
(AD-A041645; RADC-TR-77-212) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report contains the full study findings for SOW Task 4.3. The results of the study were that Top-Down Structured Programming and Formal Inspections are compatible and can be used in combination during software development. Prior to recommending full-scale use, RADC should implement the recommended inspection methodology on a variety of selected software projects using Top-Down Structured Programming. Author (GRA)

N77-31846# Illinois Univ., Urbana-Champaign.
IMPROVING PROGRAMS BY SOURCE-TO-SOURCE TRANSFORMATION Ph.D. Thesis
Paul Edward Rutter Apr. 1977 118 p refs
(Contracts DAAB07-72-C-0259; N00014-75-C-0612)
(AD-A041776; R-765; UILU-ENG-77-2212) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes a program manipulation system which speeds up Lisp programs by rewriting them. The system can read in programs and input test sets, run the program in a controlled fashion, and propose and carry out changes to the program which may result in faster execution and better algorithms. Improvements fall into two categories: those based solely on the program text, and those which use information learned from running the program. Changes are tested for correctness (program gives the same answers) and effectiveness (actually speeds the program up). Discussed in the thesis are the programmable language-oriented editor which carries out transformation commands, the library of patterns used to organize program transformations, a data and control flow analysis routine, and tools for investigating the dynamic behavior of programs. One section is devoted to a discussion of the controversy surrounding the area of program proving, and gives arguments in support of the programmer-aided program testing techniques used in the transformation system. The system was applied to a number of programs, ranging in size from single functions to large programs twenty-five pages in length. The improved programs had execution speeds ten to fifty per cent faster than the originals. Author (GRA)

N77-31847# Energy Research and Development Administration, Washington, D.C.
REAL-TIME BASIC FOR CAMAC
Feb. 1977 18 p
(TID-26619) Avail: NTIS HC A02/MF A01

An extension to BASIC is recommended in which CAMAC is introduced as part of a general real-time scheme. The language is extended by the introduction of interrupt handling, real-time operations, and CAMAC entities in the form of process variables. The only major change to the syntax is the introduction of declaration statements to assign attributes to process variables. The extension is in keeping with the general philosophy of BASIC, and reflects current trends in real-time language and operating system design. ERA

N77-31848# California Univ., Livermore. Lawrence Livermore Lab.
UTILITY ROUTINE. SUMMARY SHEETS
Jeffrey C. Huskamp, Pete Nickolas, Mathilde J. Killian, Dave Thompson, and Jim Minton 23 Aug. 1976 131 p Revised
(Contract W-7405-eng-48)
(TID-27375Rev-3; UR-003-Rev-3) Avail: NTIS HC A07/MF A01

Concise summary sheets are given as a quick reference for the utility routines available on the Octopus system at LLL. The summaries assume that the reader is at least familiar with the routine needed, so that a brief description is all that is required. ERA

N77-31849# Brookhaven National Lab., Upton, N. Y.
DEVELOPMENT OF A COMPUTER CODE FOR THERMAL HYDRAULICS OF REACTORS (THOR) Quarterly Progress Report, Jan. - Mar. 1976
Wolfgang Wulff Dec. 1976 52 p refs
(Contract EY-76-C-02-0016)
(BNL-NUREG-50569; QPR-6) Avail: NTIS HC A04/MF A01

Work was done to construct a computer code for the prediction of thermohydraulic transients in water-cooled nuclear reactor systems. The fundamental formulation of fluid dynamics is to be based on the one-dimensional drift flux model for non-homogeneous, nonequilibrium flows of two-phase mixtures. Particular emphasis is placed on component modeling, automatic prediction of initial steady state conditions, inclusion of one-dimensional transient neutron kinetics, freedom in the selection of computed spatial detail, development of reliable constitutive descriptions, and modular code structure. ERA

N77-31850# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
AN ALGORITHM FOR THE PRODUCTION OF AN ISOMETRIC PROJECTION OF A THREE-DIMENSIONAL SURFACE
C. Hall Mar. 1977 32 p refs Supersedes NPL-NAC-41
(NPL-NAC-75; NPL-NAC-41) Avail: NTIS HC A03/MF A01

An algorithm is given for producing an isometric projection of a three-dimensional surface $z=z(x,y)$ where z is defined over a regular mesh of squares. The surface is displayed by drawing parallel sections through the surface. Hidden lines are removed by comparing the visibility of the section with that of a stored visible profile. Both ALGOL and FORTRAN implementations are available; the ALGOL implementation is appended. Author (ESA)

N77-31851# TRW Defense and Space Systems Group, Redondo Beach, Calif.
A SEMANOL (76) SPECIFICATION OF MINIMAL BASIC, VOLUME 1 Final Technical Report, 27 Apr. 1976 - 27 Jan. 1977
Paul T. Berning May 1977 54 p
(Contract F30602-76-C-0245)
(AD-A040989; RADC-TR-77-170-Vol-1; FTR-27) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes the work performed and the results achieved in the preparation of a SEMANOL (76) metalanguage specification of the Minimal BASIC programming language. It explains the formal specification of Minimal BASIC produced, the SEMANOL (76) system used for the specification, and the ambiguities found in the Minimal BASIC draft proposal as a consequence of preparing this formal specification. The report also includes a suggested approach to formalizing machine dependent aspects of arithmetic and source language optimization; unfortunately, a lack of time did not permit these methods to be applied to Minimal BASIC. The SEMANOL specification of Minimal BASIC was extensively computer tested with SEMANOL (76) Interpreter; an operational specification of Minimal BASIC was thus created. Author (GRA)

N77-31852# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MINIMAL BASIC SEMANOL (76) SPECIFICATION LISTING, VOLUME 2

Frank C. Belz, Ruth M. Hart, and Dennis M. Heimbigner May 1977 161 p
(Contract F30602-76-C-0245)
(AD-A040990; RADC-TR-77-170-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report contains a listing of the SEMANOL (76) metalanguage specification of the Minimal BASIC programming language. The specification is complete and has been extensively computer tested. The SEMANOL (76) metalanguage used here is a formal one that has an interpretive approach; its use has allowed implementation dependent semantics to be included in this specification. Author (GRA)

N77-31853# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
SATMODEL USER'S GUIDE
James D. Foley and Victor L. Wallace Sep. 1976 71 p
(Contract F30602-76-C-0117)
(AD-A040923) Avail: NTIS HC A04/MF A01 CSCL 09/2

During the past several years a set of programs has been developed at the University of North Carolina to model and optimize the performance of satellite graphics systems. The programs, originally executed as batch jobs on an IBM 360 or 370 with OS/360, have now been converted, extended, and augmented to execute interactively on a Honeywell 645 or 6045 with the MULTICS operating system. This guide describes the basic concepts involved in using the interactive programs, which are herein referred to as SATMODEL. A companion document, The SATMODEL Reference Manual, gives details of the system's use. GRA

N77-31854# RAND Corp., Santa Monica, Calif.
AN INTRODUCTION TO PRODUCTION SYSTEMS
D. A. Waterman Nov. 1976 15 p refs
(AD-A040891; P-5751) Avail: NTIS HC A02/MF A01 CSCL 09/2

Production systems provide a simple, uniform way of handling control flow and data management in programs which exhibit intelligent behavior. They are particularly useful for developing programs which can learn from experience, i.e., which can demonstrate adaptive behavior. In this brief introduction to the subject the concept of the production system is defined, and simple examples of production systems are presented. Current applications of production system technology are also discussed. Author (GRA)

N77-31855# Stanford Univ., Calif. Dept. of Computer Science.
REFERENCE MACHINES REQUIRE NON-LINEAR TIME TO MAINTAIN DISJOINT SETS
Robert Endre Tarjan Mar. 1977 48 p refs
(Contract N00014-76-C-0688; Grant NSF-MCS-75-22870)
(AD-A041292; SU-STAN-CS-77-603) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a machine model intended to be useful in deriving realistic complexity bounds for tasks requiring list processing. As an example of the use of the model, the paper shows that any such machine requires non-linear time in the worst case to compute unions of disjoint sets on-line. All set union algorithms known to me are instances of the model and are thus subject to the derived bound. One of the known algorithms achieves the bound to within a constant factor. Author (GRA)

N77-31856# Ohio State Univ., Columbus. Computer and Information Science Research Center.
DBC SOFTWARE REQUIREMENTS FOR SUPPORTING NETWORK DATABASE
Jayanta Banerjee, David K. Hsiao, and Douglas S. Kerr Jun. 1977 99 p refs
(Contract N00014-75-C-0573)
(AD-A041651; OSU-CISRC-TR-77-4) Avail: NTIS HC A05/MF A01 CSCL 05/2

This is the second of a series of reports aimed at studying the capabilities of a database computer, known as the DBC, in supporting the three major data models: hierarchical, network, and relational. In the first report, DBC software requirements for handling hierarchical databases have been presented. This report will be directed towards an investigation of the software requirements for network databases. Relational database systems will be treated in a forthcoming report. The April 1971 report of the CODASYL database Task Group (DBTG) is chosen as the definitive document of network databases and systems since most commercially available network data base management systems are based on the DBTG report. Even though many of these commercial systems use a syntax that is slightly different from the DBTG specifications, the main concepts have been retained. The network database model studied in this report will be referred to as the DBTG data model. Our emphasis will be on concepts rather than the detailed syntax of the DBTG language specifications. Database computers are a recent addition to the family of computers. With the advent of large databases, there has been a growing awareness of the necessity of a computer architecture that is oriented towards storage, retrieval, and manipulation of large quantities of information. GRA

N77-31857# Research Inst. of National Defence, Stockholm (Sweden).
MOVING PICTURES SHOW SIMULATION TO USER
Jacob Palme Apr. 1977 17 p refs
(PB-267773/0; FOA-C-10068-M3(E5)) Avail: NTIS HC A02/MF A01 CSCL 09B

One of the most difficult problems with a simulation program is to gain confidence in the accurateness and reliability of the model. If the program is to be used for important decisions, the decision makers must feel sure that the model can be depended on. To do this, it must be understood what is happening in the program. One way of making the users of the simulation more sure about what is happening in the program is to show what is happening during a simulation as a 'moving picture' on a terminal. This can easily be done on a simple standard alphanumeric display terminal. The extra programming effort is small, and the gain in understanding of the model is high, both for the programmer and for other users. GRA

N77-31858 Carnegie-Mellon Univ., Pittsburgh, Pa.
DESIGN TOOLS FOR EVALUATING MULTIPROCESSOR PROGRAMS Ph.D. Thesis
Phillip Howard Mason 1976 192 p
Avail: Univ. Microfilms Order No. 77-7798

An approach to designing programs for implementation in a multiple instruction stream-multiple data stream processing environment is presented. A program is modeled as a directed graph consisting of two types of nodes: processing nodes and linking nodes. Communication among nodes in the model is represented by message tokens. Each processing node is similar in form to a semi-Markov process. A simulation of the operation of the model is nondeterministic, but is based on prescribed probabilitic choice functions. A system, called STEPPS, has been built in which a model can be described and evaluation tools can be used to manipulate and act upon a model to predict performance of a program decomposition. Dissert. Abstr.

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Includes computer networks.

N77-31859*# Teledyne Brown Engineering, Huntsville, Ala. Systems Div.
PROGRAMMABLE DATA COMMUNICATIONS CONTROLLER REQUIREMENTS Final Report
Jul. 1977 61 p
(Contract NAS8-31488)
(NASA-CR-150384; SD77-MSFC-2115) Avail: NTIS HC A04/MF A01 CSCL 09B

The design requirements for a Programmable Data Communications Controller (PDCC) that reduces the difficulties in attaching data terminal equipment to a computer are presented. The PDCC is an interface between the computer I/O channel and the bit serial communication lines. Each communication line is supported by a communication port that handles all line control functions and performs most terminal control functions. The port is fabricated on a printed circuit board that plugs into a card chassis, mating with a connector that is joined to all other card stations by a data bus. Ports are individually programmable;

each includes a microprocessor, a programmable read-only memory for instruction storage, and a random access memory for data storage. Author

N77-31860# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
FINDING MINIMUM CUTSETS IN REDUCIBLE GRAPHS
Adi Shamir Jun. 1977 31 p refs Sponsored in part by ARPA
(Contract N00014-76-C-0366)
(AD-A040698; MIT-LCS-TM-85) Avail: NTIS HC A03/MF A01 CSCL 12/2

The analysis of many processes modelled by directed graphs requires the selection of a subject of vertices which cut all the cycles in the graph. Reducing the size of such a cutset usually leads to a simpler and more efficient analysis, but the problem of finding minimum cutsets in general directed graphs is known to be NP-complete. In this paper we show that in reducible graphs and (thus in almost all the practical flowcharts of programs), minimum cutsets can be found in linear time. An immediate application of this result is in program verification systems based on Floyd's inductive assertions method. Author (GRA)

N77-31861# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
COMPARATIVE ANALYSIS OF ROUTING ALGORITHMS FOR COMPUTER NETWORKS Ph.D. Thesis
Joe Edmund Defenderfer Jun. 1977 158 p refs
(Contract N00014-75-C-1183; ARPA Order 3045)
(AD-A041293; ESL-R-756) Avail: NTIS HC A08/MF A01 CSCL 17/2

The routing problem in a computer-communication network is modeled as a multicommodity flow problem. Two generalizations of the EF algorithm of Cantor and Gerla for solving the nonlinear multicommodity flow problem are presented. These generalizations are of interest because they retain identity of the components of the solution in an implicit and compact manner. A mini-max routing problem is defined as a linear program, and a methodology for its solution as both a linear and nonlinear program is presented. The two approaches are compared with each other, and a lower bound on the solution is developed for the nonlinear approach. Two shortest route algorithms which are very efficient for classes of topologies likely to be considered in routing problems are introduced. The shortest route problem is a subproblem of all of the routing algorithms mentioned above. The computer load sharing problem is formulated as a multicommodity flow problem. An algorithm is presented to solve the load sharing problem which exploits the special structure of the problem. Author (GRA)

N77-31862# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
DEVELOPMENT OF A HIERARCHICAL, DYNAMICALLY RECONFIGURABLE INPUT/OUTPUT NETWORK M.S. Thesis - MIT
James R. Seeley Jun. 1977 115 p refs
(Contract N00014-76-C-0502; Grant NSF DCR-74-24116)
(AD-A041186; T-644) Avail: NTIS HC A06/MF A01 CSCL 17/2

This thesis traces the development of the hierarchical, dynamically reconfigurable, input/output network which has been constructed at the Draper Laboratory. It presents a summary of the design procedures used in determining the network architecture, communication methods, message formats, and overall topology. Further, it describes both the hardware and software features that have been implemented in the network's microprocessor-based nodes. In addition, the centrally located software algorithms developed to configure, repair, and monitor the network have been extensively discussed. Finally, the thesis also includes a reliability analysis of the network in a typical application, and a performance evaluation of the effectiveness of the configuration and control programs. GRA

N77-31863# Stanford Research Inst., Menlo Park, Calif.
ARPANET RESOURCE HANDBOOK
Elizabeth J. Feinler, Tohanna M. Landsberden, and Adrian C. McGinnis Dec. 1976 778 p Supersedes NIC-23200
(Contract DCA200-76-C-0611)
(AD-A040452; NIC-393; NIC-23200) Avail: NTIS HC A99/MF A01 CSCL 09/2

The Resource Handbook is a compendium of resources available for use on the ARPANET. Enough descriptive procedure is included to permit a user to find and access many of these resources. In addition, the handbook contains general information about the ARPANET, lists useful network contacts, and cites bibliographic references and online documentation. It is aimed toward the novice user or the network user who may not be familiar with hosts (computers) other than his own. Although the handbook attempts to provide enough information to guide the user around the ARPANET, it does not attempt to provide in depth descriptions of software, hardware configurations, operating systems, and the like. Author (GRA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N77-31864*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
COMPENSATOR IMPROVEMENT FOR MULTIVARIABLE CONTROL SYSTEMS Final Report, 25 Aug. 1976 - 25 Aug. 1977
Jerrel R. Mitchell, Willie L. McDaniel, Jr., and Lennor Lynn Gresham 25 Aug. 1977 154 p refs
(Contract NAS8-31568)
(NASA-CR-150392; MSSU-EIRS-EE-78-1) Avail: NTIS HC A08/MF A01 CSCL 09B

A theory and the associated numerical technique are developed for an iterative design improvement of the compensation for linear, time-invariant control systems with multiple inputs and multiple outputs. A strict constraint algorithm is used in obtaining a solution of the specified constraints of the control design. The result of the research effort is the multiple input, multiple output Compensator Improvement Program (CIP). The objective of the Compensator Improvement Program is to modify in an iterative manner the free parameters of the dynamic compensation matrix so that the system satisfies frequency domain specifications. In this exposition, the underlying principles of the multivariable CIP algorithm are presented and the practical utility of the program is illustrated with space vehicle related examples. Author

N77-31865# Yale Univ., New Haven, Conn. Systems and Information Sciences.
ADAPTIVE CONTROL OF SINGLE-INPUT, SINGLE-OUTPUT LINEAR SYSTEMS
A. Feuer and A. S. Morse Apr. 1977 23 p refs
(Grant AF-AFOSR-3176-77)
(AD-A040160; S/IS-7701; AFOSR-77-0660TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

A procedure is presented for designing an adaptive control for a single-input, single-output process admitting an essentially unknown but fixed linear model, so that the resulting closed-loop system is stable with zero steady-state tracking error between the output of the process and the output of a prespecified linear reference model. The adaptive controller is a differentiator-free dynamical system forced only by the process input and output, as well as a reference input. Author (GRA)

N77-31866# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
IMAGE UNDERSTANDING AND INFORMATION EXTRACTION Final Technical Report, 1 Nov. 1975 - 31 Oct. 1976
Thomas S. Huang and King-Sun Fu Griffiss AFB, N. Y. RADC Mar. 1977 179 p refs
(Contract F30602-75-C-0150; ARPA Order 2893)
(AD-A040138; RADC-TR-77-102) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report summarizes the results of the research program on Image Understanding and Information Extraction at Purdue University supported by the Defense Advanced Research Projects Agency. The objective of our research is to achieve a better understanding of image structure and to use this knowledge to

develop techniques for image analysis and processing tasks, especially information extraction. Our emphasis is on syntactic decomposition and recognition of imagery based on scene analysis. It is our expectation that this research will form a basis for the development of technology relevant to military applications of machine extraction of information from aircraft and satellite imagery. GRA

N77-31867# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.

SHAPE DESCRIPTION VIA THE USE OF CRITICAL POINTS Interim Report

Herbert Freeman 6 Jun. 1977 18 p refs

(Contract AF-AFOSR-2937-76)

(AD-A040273; AFOSR-77-0677TR) Avail: NTIS HC A02/MF A01 CSCL 14/5

A key element in pattern recognition is the description of shape. For two-dimensional objects (blobs), shape is conveyed by the curving of the boundary line and is normally considered independent of scale and orientation. The curving may be regarded as a concatenation of arcs of varying instantaneous radii of curvature, possibly interspersed occasionally by discontinuities. The description of shape is facilitated by segmenting the boundary line at so-called critical point - corners (discontinuities in curvature), points of inflection, and curvature maxima. Additional critical points are intersections and points of tangency. Algorithms are described for extracting such critical points in the presence of noise. An illustration is given showing how the critical points may be used in the development of a shape description system. Author (GRA)

N77-31868# Naval Postgraduate School, Monterey, Calif.

COMPARISON OF A DETERMINISTIC AND A STOCHASTIC FORMULATION FOR THE OPTIMAL CONTROL OF A LANCHESTER-TYPE ATTRITION PROCESSES

James G. Taylor and Robert L. Powers Apr. 1977 62 p refs Presented at Intern. Symp. on Appl. of Computers and Operations Res. to Problems of World Concern, Washington, D. C., Aug. 1973

(RR0000101)

(AD-A041150; NPS55-77-18) Avail: NTIS HC A04/MF A01 CSCL 12/1

The structure of the optimal fire distribution policy obtained using a deterministic combat attrition model is compared with that for a stochastic one. The same optimal control problem for a homogeneous force in Lanchester combat against heterogeneous forces is studied using two different models for the combat dynamics (the usual deterministic Lanchester-type differential equation formulation and a continuous parameter Markov chain with stationary transition probabilities). Both versions are solved using modern optimal control theory (the maximum principle (including the theory of state variable inequality constraints) for the deterministic control problem and the formalism of dynamic programming for the stochastic control problem). Numerical results have been generated using a digital computer and are compared. Author (GRA)

N77-31869# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

APPLICATION OF OPTIMAL CONTROL THEORY TO DYNAMIC ROUTING IN DATA COMMUNICATION NETWORKS

Franklin Howard Moss Feb. 1977 309 p refs

(Contract N00014-75-C-1183; ARPA Order 3045)

(AD-A041241; ESL-R-721) Avail: NTIS HC A14/MF A01 CSCL 17/2

The flow of messages in a message-switched data communication network is modeled in a continuous dynamical state space. The state variables represent message storage at the nodes and the control variables represent message flow rates along the links. A deterministic linear cost functional is defined which is the weighted total message delay in the network when we stipulate that all the message backlogs are emptied at the final time and the inputs are known. Minimization of the cost functional results in a linear optimal control problem with linear state and control variable inequality constraints. The remainder of the report is devoted to finding the feedback solution to the optimal control problem when all the inputs are constant in time. First, the necessary conditions of optimality are derived and shown to be sufficient. The pointwise minimization in time is a linear program and the optimal control is shown to be of the bang-bang variety. There are several properties of the method which complicate its formulation as a compact algorithm for general network problems. However, in the case of problems involving networks with single destinations and all unity weightings in the cost functional it is shown that these complications do not arise. Author (GRA)

N77-31870# Loughborough Univ. of Technology (England). Dept. of Mathematics.

SOME RECENT DEVELOPMENTS IN OPTIMAL CONTROL THEORY

M. A. Connor Feb. 1976 30 p refs

(MATHS-Res-92) Avail: NTIS HC A03/MF A01

Basic concepts and results of optimal control theory are reviewed with emphasis on recent UK research activity in this field. As the necessary conditions for optimality can rarely be solved analytically, applications of optimal control theory frequently involve numerical iterative techniques. Some standard iterative procedures are discussed including the contraction mapping algorithm, the gradient algorithms, the Mane's algorithm, the Balakrishan's method avoiding the numerical integration, the state space constraints, and singular problems involving a penalty function approach. ESA

N77-31871# Loughborough Univ. of Technology (England). Dept. of Mathematics.

A NEW ALGORITHM FOR CONSTRAINED OPTIMIZATION, WITH APPLICATION TO OPTIMAL CONTROL

S. J. Leese Mar. 1976 32 p refs Sponsored by Sci. Res. Council

(MATHS-Res-94) Avail: NTIS HC A03/MF A01

A new algorithm is presented for the numerical solution of nonlinear optimization problems: maximize F(u) subject to G(u) = O' with equality constraints. The algorithm seems to optimize F and reduce G to zero at the same time. It is a generalization of the gradient projection method. Two convergence theorems are given and it is shown how the method may be applied to optimal control problems with terminal constraints. Results are given of an actual calculation involving a particular time lag control problem of neutral type. Author (ESA)

N77-31872# Hughes Research Labs., Malibu, Calif.

MULTIDITHER ADAPTIVE ALGORITHMS Final Technical Report, 1 Aug. 1975 - 30 Mar. 1977

Richard C. Lind, M. L. Minden, S. Hansen, and T. A. Nussmeier May 1977 75 p refs

(Contract F30602-76-C-0022; ARPA Order 1279)

(AD-A040247; RADC-TR-77-1) Avail: NTIS HC A04/MF A01 CSCL 20/6

Various analytic and experimental algorithms that can reduce the beam distortions caused by thermal blooming were investigated. A 19-element beryllium deformable mirror was used in the DARPA/RADC Coherent Optical Adaptive technique system to perform the experimental compensation studies. Using this system, both spatial and temporal algorithms employing zonal multidither and modal multidither using Zernike polynomials have been studied. A major result from this work is the identification of certain algorithms which can compensate for thermal blooming. The specific algorithms involved and the degree of correction achieved depended on the blooming scenario studied. Experimental results indicated that standard zonal system gave blooming correction over a larger set of parameters than did the Zernike polynomial system. This is believed to result from cross coupling and limited Zernikes - both caused by poor representation of the actual Zernike by the deformable mirror. Sequencing studies, both analytic and experimental, showed no preferred sequences but did indicate that focus and/or astigmatism always dominated the correction. Numerical studies employing multidither coherent optical adaptive techniques, function maximization, and phase-conjugate algorithms were performed. Function maximization gave better correction than either of the other two. Servo convergence time was varied on the multidither system with the results indicating no change in correction. Author (GRA)

N77-31873# RAND Corp., Santa Monica, Calif.
THE ROLE OF PARTIAL AND BEST MATCHES IN KNOWLEDGE SYSTEMS
Roth Frederick Hayes Jan. 1977 39 p refs
(AD-A040883; P-5802) Avail: NTIS HC A03/MF A01 CSCL 06/4

Partial matching is a comparison of two or more descriptions that identifies their similarities. Determining which of several descriptions is most similar to one description of interest is called the best match problem. Partial and best matches underlie several knowledge system functions, including: analogical reasoning, inductive inference, predicate discovery, pattern-directed inference, semantic interpretation, and speech and image understanding. Because partial matching is both combinatorial and ill-structured, admissible algorithms are elusive. Economical solutions require very effective use of constraints that, apparently, can be provided only by globally organized knowledge bases. Examples of such organizations are provided, and promising avenues of research are proposed. Author (GRA)

N77-31874# Maryland Univ., College Park. Computer Science Center.
PICTORIAL INFORMATION PROCESSING AND ANALYSIS Final Report, 1 May 1972 - 30 Apr. 1977
Azriel Rosenfeld 1 May 1977 11 p refs
(Contract F44620-72-C-0062)
(AD-A040149; AFOSR-77-0667TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper deals with the specific research activities that were carried out and grouped under six headings: (1) segmentation of pictures into distinctive regions, (2) detection of significant local features (such as edges) in a picture, (3) picture approximation, (4) picture manipulation and enhancement, (5) picture processing software, and (6) picture analysis applications: terrain analysis, cloud pattern recognition. Author (GRA)

N77-31875# Minnesota Univ., Minneapolis. Dept. of Psychology.
A RAPID ITEM-SEARCH PROCEDURE FOR BAYESIAN ADAPTIVE TESTING
David C. Vale and David J. Weiss May 1977 20 p refs
(Contract N00014-76-C-0243)
(AD-A041090; RR-77-4) Avail: NTIS HC A02/MF A01 CSCL 12/2

An alternative item-selection procedure for use with Owen's Bayesian adaptive testing strategy is proposed. This procedure is, by design, faster than Owen's original procedure because it searches only part (as compared with all) of the total item pool. Item selections are, however, identical for both methods. After a conceptual development of the rapid-search procedure, the supporting mathematics are presented. In a simulated comparison with three item pools, the rapid-search procedure required as little as one-tenth the computer time as Owen's technique. Author (GRA)

N77-31876# Threshold Technology, Inc., Delran, N. J.
ALPHA/NUMERIC EXTRACTION TECHNIQUE PHASE 2 Final Technical Report
Phillips B. Scott May 1977 36 p
(Contract F30602-76-C-0309)
(AD-A041759; RADC-TR-77-184) Avail: NTIS HC A03/MF A02 CSCL 09/2

This report describes a 2-part program (1) to interface an existing word recognition system (WRS) to a bathymetric digitizer and (2) to develop a new word recognition system for a large vocabulary. The first program provides an improved means for entering bathymetric readings from smooth sheets to punched cards. The WRS allows a cartographer simultaneously to obtain X-Y coordinate locations and provide voice data entry of depth reading for each coordinate location. With the operator's hands free to concentrate on the X-Y position sensing cursor he can speak the depth numbers. If they are correctly recognized, he can enter them onto punched cards without losing sight of the smooth sheet. The cartographic WRS which was interfaced to the digitizer is described in AD-B008 303L. The complete system has been installed at the Defense Mapping Agency Hydrographic Center at Suitland, Md. The large vocabulary WRS will be used to explore other cartographic applications. This system is based upon the VIP-100, a WRS system with capability of recognizing up to 200 separate words in a syntactic structure. The structure allows up to 30 words in any node of the structure. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-31877*# Tennessee Univ., Knoxville. Engineering Experiment Station.
ANALYTICAL SOLUTIONS FOR NON-LINEAR DIFFERENTIAL EQUATIONS WITH THE HELP OF A DIGITAL COMPUTER
Paul C. Cromwell 31 Jan. 1964 89 p refs
(Contract NAS8-2558)
(NASA-CR-150386) Avail: NTIS HC A05/MF A01 CSCL 12A

A technique was developed with the help of a digital computer for analytic (algebraic) solutions of autonomous and nonautonomous equations. Two operational transform techniques have been programmed for the solution of these equations. Only relatively simple nonlinear differential equations have been considered. In the cases considered it has been possible to assimilate the secular terms into the solutions. For cases where f(t) is not a bounded function, a direct series solution is developed which can be shown to be an analytic function. All solutions have been checked against results obtained by numerical integration for given initial conditions and constants. It is evident that certain nonlinear differential equations can be solved with the help of a digital computer. Author

N77-31878# Naval Postgraduate School, Monterey, Calif.
IMPROVED FINITE DFFERENCE FORMULAS FOR BOUNDARY VALUE PROBLEMS
T. H. Gawain and R. E. Ball 1 May 1977 44 p refs
(AD-A040072; NPS-67GN77051) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper deals with the numerical solution of linear differential equations of fourth order by finite differences. It points out significant (but usually overlooked) errors which result from the conventional method of imposing the boundary conditions in such problems. Revised finite difference formulas are derived which apply near the boundaries and which eliminate the above errors. Three commonly encountered boundary conditions are considered. These correspond, in the terminology of beam analysis, to a clamped end, to a simply supported end and to a free end. The improvement in accuracy that can be achieved with the revised formulas is illustrated by two representative examples. The revised formulas are shown to reduce the overall error of the numerical solution by a factor of about five in a typical case. Author (GRA)

N77-31879# George Washington Univ., Washington, D.C. Dept. of Operations Research.
BOUNDING GLOBAL MINIMA WITH INTERVAL ARITHMETIC Interim Report
Louis J. Mancini (Shell Develop. Co., Houston, Tex.) and Garth P. McCormick 31 Jan. 1977 26 p refs
(Grant AF-AFOSR-2504-73)
(AD-A040150; AFOSR-77-0668TR; Serial-T-345) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is shown how techniques of interval arithmetic can be used to give bounds on the global minima of unconstrained optimization problems. The techniques are illustrated using the design of a hypothetical chemical plant. Author (GRA)

N77-31880# DBA Systems, Inc., Melbourne, Fla.
DIGITAL TERRAIN DATA COMPACTION USING ARRAY ALGEBRA Final Contract Report
Urho Rauhala and Stephen Gerig Nov. 1976 61 p refs
(Contract DAAG53-76-C-0127)
(AD-A041039; ETL-0108) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report investigates the applicability of array algebra digital terrain modeling and data compaction. Two options were evaluated

for converting the collected data into regularly spaced terrain elevations. First, an array prediction is performed of the data directly in the epipolar coordinate frame. This approach allows for data compaction and subsequent evaluation at uniform intervals in a gridded map coordinate system. Second, the principle of array algebra in a piecewise translocation algorithm is applied. In this approach the non-gridded epipolar coordinates are first converted to regularly spaced elevation data and then subsequently compacted using the methods of array prediction. In addition to analyzing the mathematical equations required for terrain compaction, the computational requirements were analyzed for both sequential and parallel processors. Author (GRA)

N77-31881# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONFIDENCE BOUNDS FOR THE GENERAL LINEAR MODEL Final Report
Malcolm S. Taylor and J. Richard Moore May 1977 18 p refs
(DA Proj. 1T1-61102-AH-43)
(AD-A041035; BRL-1986) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, for the general linear model Y = X beta - e, we consider the construction of confidence bounds about the entire regression line. To accomplish this we exploit a powerful theorem of Scheffe. A procedure often encountered is one in which a set of confidence intervals about E(y,x) or prediction intervals for future observations are determined and then the end points are connected in such a fashion as to describe an envelope. The belief is that what has been accomplished is precisely what Scheffe's theorem allows one to do. In addition, we present some extensions concerning confidence bounds about combinations of regression lines and suggest a useful application of these results. Specifically, we propose to use the confidence bounds about the difference of regression lines to make a quantitative assessment of when and where independent sets of data characterizing the same phenomena are in agreement or disagreement. GRA

N77-31882# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
AN AUTOMATIC METHOD FOR THE NUMERICAL SOLUTION OF INTEGRO-DIFFERENTIAL-DIFFERENCE EQUATIONS Final Report M.S. Thesis
Arthur E. Goldberger, Jr. St. Louis, Mo. AAVSCOM Apr. 1977 25 p refs Sponsored by Army
(AD-A040801; USAAVSCOM-TR-77-34) Avail: NTIS HC A02/MF A01 CSCL 12/1

An integro-differential-difference equation may be represented by a power series-given an initial value. Additional coefficients of the power series can be obtained through numeric continuation and a power series representation of the solution can be obtained for any finite range about the center of expansion by the use of recurrence relations developed through this study. The use of power series as the solution method enables the memory or history of the equation to be retained. Author (GRA)

N77-31883# Illinois Univ., Chicago. Dept. of Mathematics.
REPEATED MEASUREMENTS DESIGNS, 2 Interim Report
A. Hedayat and K. Afsarinetad 1977 22 p refs Prepared in cooperation with Florida State Univ.
(Grants AF-AFOSR-3050-76; NSF MPS-75-07570; NSF MCS-07217)
(AD-A040193; AFOSR-77-0678TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Repeated measurements designs are concerned with scientific experiments in which each experimental unit is assigned more than once to a treatment, either different or identical. It is shown that a family of balanced repeated measurements designs which are very popular among experimenters are universally optimal in a relatively large class of competing designs.
Author (GRA)

N77-31884# IBM Watson Research Center, Yorktown Heights, N.Y.
NUMERICAL METHODS FOR STIFF NONLINEAR AND QUADRATIC DIFFERENTIAL EQUATIONS Final Report, 1 Mar. 1975 - 28 Feb. 1977
Werner Liniger Apr. 1977 21 p refs
(Contract F44620-75-C-0058)
(AD-A040587; AFOSR-77-0642TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This contract was concerned with research in nonlinear and linear stability of multistep methods, special high-order A-stable methods, fractional linear difference schemes for quadratic differential equations, and rotational solutions of the Josephson phase equations. This report summarizes the results obtained in each of these four areas, and gives references to the full accounts appearing in various research papers. GRA

N77-31885# Johns Hopkins Univ., Baltimore, Md.
LOCAL CONVERGENCE OF THE DIAGONALIZED METHOD OF MULTIPLIERS
R. H. Byrd 28 Oct. 1976 21 p refs
(Contract EY-76-S-05-5046)
(ORO-5046-3) Avail: NTIS HC A02/MF A01

A modification of the method of multipliers of Hestenes and Powell is considered in which the iteration is diagonalized, that is, only a fixed finite number of iterations of Newton's method are taken in the primal minimization stage. Conditions are obtained for quadratic convergence of the standard method, and it is shown that a diagonalization where two Newton steps are taken preserves the quadratic convergence for all multiplier update formulas satisfying these conditions. ERA

N77-31886# California Univ., Los Angeles. Dept. of Engineering Systems.
PARAMETER OPTIMIZATION FOR LINEAR QUADRATIC DIFFERENTIAL GAMES Interim Report
C. T. Leondes and T. K. Siu 13 Jan. 1977 6 p refs
(Grant AF-AFOSR-2958-76)
(AD-A039583; AFOSR-77-0564TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A fundamental result of optimal control theory is that the optimal control of linear systems leads to an optimal performance cost that is a function of the system parameters. Therefore it is reasonable for the system designer to further minimize the performance measure by manipulating the values of certain parameters if this can be done. Above all, is shown that the above technique could be extended to linear quadratic zero sum differential games because the analytic methods derived for them are actually extensions of technique used in control.
Author (GRA)

N77-31887# Minnesota Univ., Minneapolis.
F-REDUCTION OF THE OPERATOR RICCATI EQUATIONS FOR HEREDITARY DIFFERENTIAL SYSTEMS Interim Report
M. C. Delfour, E. B. Lee, and A. Manitius Apr. 1977 13 p refs Prepared in cooperation with Montreal Univ., Quebec
(Grant AF-AFOSR-2243-72)
(AD-A039584; AFOSR-77-0567TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The Riccati equation for the linear quadratic optimal control problem involving retarded functional equations has been extensively studied in the literature through several alternative approaches. Among these, three quite different methods of obtaining the Riccati equation are worth mentioning: (1) the Hilbert space formulation of Delfour-Mitter using abstract evolution equations, (2) the Caratheodory lemma approach based on an extension of the Hamilton-Jacobi equation, (3) the approach via Fredholm integral equations and the related theory of the resolvent kernel. GRA

N77-31888# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
MULTISTAGE ESTIMATION OF BIAS STATES IN LINEAR SYSTEMS Interim Report
J. M. Mendel and H. D. Washburn 1977 30 p refs
(Grant AF-AFOSR-2797-75)
(AD-A039764; AFOSR-77-0565TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper provides an alternate, constructive derivation of Friedland's method (Ref 1) for recursive bias filtering; and, extends his method to the case where we may wish to increase (or decrease) the number of biases. We show that it is possible to

add (or delete) bias states in such a manner that previously computed quantities can be used to obtain new estimates of the dynamical state vector and the now-larger bias vector. Adding (or deleting) bias states is important when, for example, the bias states are used to model constant, but unknown, instrumentation error sources, of which there can be a large number.
Author (GRA)

N77-31889# Naval Research Lab., Washington, D. C.
APPLICATION OF SPEED IMPROVEMENT TECHNIQUES IN COORDINATE TRANSFORMATIONS FOR THE MULTIPLE PLATFORM SENSOR INTEGRATION PROBLEM Memorandum Report
Ben H. Cantrell May 1977 9 p
(AD-A040797; NRL-MR-3520) Avail: NTIS HC A02/MF A01 CSCL 12/1

A means of improving the speed of computation in performing coordinate transformation used in multiple platform sensor integration problems is described. The method is based on quaternions. Author (GRA)

N77-31890# Colorado State Univ., Fort Collins. Dept. of Mathematics.
ADAPTIVE PIECEWISE POLYNOMIAL UNIFORM APPROXIMATION
Joseph A. Hull Mar. 1977 30 p refs
(Grant AF-AFOSR-2878-76)
(AD-A040147; AFOSR-77-0643TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This thesis presents two algorithms for the computation of smooth piecewise polynomial approximations which are adaptive in nature and which are based upon results from uniform approximation theory. It also presents a discussion of existing algorithms for computing uniform approximations, uniform approximations with interpolatory constraints, and restricted range uniform approximation. Finally, numerical testing of our two algorithms is reported and suggestions offered for their effective use. GRA

N77-31891# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
CONTOURING AND HIDDEN-LINE ALGORITHMS FOR VECTOR GRAPHIC DISPLAYS Final Report, Aug. 1975 - Aug. 1976
James S. Petty and Kervyn D. Mach Jan. 1977 195 p refs
(AD-A040530; AFAPL-TR-77-3) Avail: NTIS HC A09/MF A01 CSCL 12/1

This report describes several computer graphics techniques developed by the authors to display the results of turbomachinery design and performance calculations. It begins with basic contour plotting, then shows the procedures for drawing three-dimensional figures with or without perspective and concludes with descriptions of two methods of removing hidden lines from three-dimensional scenes. Numerous examples and program listings are included. Author (GRA)

N77-31892# Tennessee Univ., Knoxville.
ITERATIVE METHODS FOR SINGULAR SYSTEMS OF EQUATIONS Final Report, 15 Apr. 1974 - 14 Apr. 1977
Robert J. Plemmons 3 Jun. 1977 6 p
(Contract DAHC04-74-C-0019)
(AD-A041512; ARO-11755.10-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The objectives of the research were to study direct and iterative methods for approximating solutions to systems of linear equations $Ax=b$, where the coefficient matrix A is singular or in general rectangular. Such problems arise in geodesy calculations, in finite difference and finite element methods for approximating solutions to certain types of partial differential equations such as the Neumann problem or Poisson's equation on a sphere, in statistical calculations in structural analysis and in Markov analysis. Author (GRA)

N77-31198*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN IMPROVED DIGITAL ALGORITHM FOR FAST AMPLITUDE APPROXIMATIONS OF QUADRATURE PAIRS
B. K. Levitt and G. A. Morris *In its* The Deep Space Network 15 Aug. 1977 p 07-101 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 12A

N77-31200*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications System Research Section.
CONCATENATED SHIFT REGISTERS GENERATING MAXIMALLY SPACED PHASE SHIFTS OF PN-SEQUENCES
W. J. Hurd and L. R. Welch (USC, Los Angeles) *In its* The Deep Space Network 15 Aug. 1977 p 110-116 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 12A

N77-31201*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. TDA Engineering Office.
ON THE FUNDAMENTAL STRUCTURE OF GALOIS SWITCHING FUNCTIONS
B. Benjauthrit and I. S. Reed (Univ. Southern Calif., Los Angeles) *In its* The Deep Space Network 15 Aug. 1977 p 117-133 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-31893 Southern Methodist Univ., Dallas, Tex.
INFERENCE PROCEDURES FOR LATENT ROOT REGRESSION ANALYSIS Ph.D. Thesis
John Walter White 1976 88 p
Avail: Univ. Microfilms Order No. 77-9782

Analysis of the large sample properties of the A'A matrix and its latent roots and vectors for various sets of regression parameters does provide a method for detecting this high parallelism case. Several statistics are proposed which enable the user of regression analysis to assess the orientation of the parameter vector and the predictiveness of a vector being considered for deletion. Also proposed is a modified estimation technique based on identifying the vector defining the multicollinearity among the latent vectors of the A'A matrix. Finally, a procedure, incorporating the above statistics, for selecting either the Least Squares or the modified Latent Root estimator is given. This rule is shown to perform well relative to the Least Squares or Latent Root procedures for several sets of model parameters.
Dissert. Abstr.

N77-31894 Pennsylvania Univ., Philadelphia.
A THEORETICAL INVESTIGATION OF STEPWISE LINEAR DISCRIMINANT ANALYSIS Ph.D. Thesis
Judith Therese Tama 1976 201 p
Avail: Univ. Microfilms Order No. 77-10228

Efforts are made to find an alternative approach to the stepwise decision by investigating an estimate of the misclassification probabilities. The assumption of two multinormal populations with a common covariance matrix is maintained. Two components of a stepwise procedure are the computational technique and the criterion for deciding between subsets. An adaptation of the fundamental optimality principle to the discriminant problem resulted in a backward elimination procedure, named Optimal Eliminat..., which guarantees the best subset for each subset size on the basis of an estimated error rate criterion. The decision between the best sets of p and p-1 variables, for all values of p, is based on an error rate criterion defined as the standardized difference of the error rate estimates. The derived expressions, as well as several simplifying approximations are evaluated for various parameter combinations and compared to simulated values. Finally, the Optimal Elimination procedure, combined with the standardized difference of error rate estimates, is applied to several examples. Dissert. Abstr.

N77-31895*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ROBUSTNESS AND COMPUTATIONAL ASPECTS OF NONLINEAR STOCHASTIC ESTIMATORS AND REGULATORS

Michael G. Safonov and Michael Athans Apr. 1977 11 p refs Submitted for publication
(Grants NGL-22-009-124; AF-AFOSR-3281-77)
(NASA-CR-154988; AD-A040314; ESL-P-741) Avail: NTIS HC A02/MF A01 CSCL 12/1

Robustness properties of nonlinear extended Kalman filters with constant gains and modelling errors are presented. Sufficient conditions for the non-divergence of state estimates generated by such nonlinear estimators are given. In addition, the overall robustness and stability properties of closed-loop stochastic regulators, based upon the Linear-Quadratic-Gaussian design methodology using linearized dynamics, are presented; the sufficient conditions for closed-loop stability have a 'separation-type' property. Author (GRA)

N77-31896# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DISCRIMINATION BETWEEN COMPETITIVE MODELS: DISC M.S. Thesis
Jose Francisco DaSilva Filho Jun. 1977 111 p refs In PORTUGUESE; ENGLISH summary
(INPE-1027-TPT/051) Avail: NTIS HC A06/MF A01

The discrimination among models which compete to represent a given system, using the Box and Hill algorithm, is the main objective of this work. Based on Bayesian statistics and information theory, this algorithm uses a sequential procedure to discriminate the best model, and indicates how to improve the discrimination between the two most competing models. A computer program was implemented, and two applications are presented, dealing with chemical reaction mechanisms and the accessibility function among urban cells, respectively. Concerning urban accessibility, it is found that the gravity function is best suited to Sao Jose dos Campos urban data. Author

N77-31897# North Carolina Univ., Chapel Hill. Dept. of Statistics.
TESTING A NORMAL SAMPLE FOR MULTIPLE OUTLIERS
Douglas M. Hawkins Nov. 1976 23 p refs
(Contract DAHC04-74-C-0030)
(AD-A040327; ARO-11959.14.M; Mimeo-Ser-1094) Avail: NTIS HC A02/MF A01 CSCL 12/1

Test statistics G and M for two outliers due to Murphy and Grubbs are compared with a test statistic R based on applying a single-outlier test to the sample with the most extreme observation removed. It is shown that G is generally most effective. The G and R procedures are shown to be equivalent when the number of outliers is unknown, and to give satisfactory performance for one or two outliers. An extension to the linear hypothesis is outlined. Author (GRA)

N77-31898# Naval Postgraduate School, Monterey, Calif.
A DIFFUSION APPROXIMATION ANALYSIS OF A GENERAL n-COMPARTMENT SYSTEM
Donald P. Gaver and John P. Lehoczky Apr. 1977 46 p refs
(Grants AF-AFOSR-2642-74; NSF AG-467)
(AD-A040202; NPS55-77-16) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new approach to the stochastic analysis of general compartment models is presented. The analysis is based on the concept of diffusion approximations. The state of a compartment system is represented as the superposition of a deterministic process, characterized by a system of ordinary differential equations, and a random noise process characterized by stochastic differential equations. All transition rate parameters are permitted to be time dependent. Numerical solutions are presented for the two-compartment case. Extensions to non-linear compartment models are discussed. GRA

N77-31899# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SOME CONSIDERATIONS IN THE EVALUATION OF ALTERNATE PREDICTION EQUATIONS
Richard F. Gunst and Robert L. Mason (Southwest Res. Inst., San Antonio, Tex.) 1977 36 p refs
(Grant AF-AFOSR-2871-75)
(AD-A040457; AFOSR-77-0688TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Prediction equations constructed from multiple linear regression analyses are often intended for use in predicting response values throughout a region of the space of the predictor variables. Criteria for evaluating prediction equations, however, have generally concentrated attention on mean squared error properties of the estimated regression coefficients or on mean squared error properties of the predictor at the design points. If adequate predication throughout a region of the space of predictor variables is the goal, neither of these criteria may be satisfactory in assessing the predictor. In this paper integrated mean squared error is used as a criterion to determine when the least squares, principal component, and ridge regression estimators of regression coefficients can produce satisfactory prediction equations in the presence of a multicollinear design matrix. Author (GRA)

N77-31900# Rochester Univ., N. Y. Dept. of Statistics.
A SIMPLE TEST FOR NORMALITY Interim Report
Govind S. Mudholkar and Chin-Chuong Lin 1977 18 p refs
(Grant AF-AFOSR-3360-77)
(AD-A041538; AFOSR-77-0769TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The mean and the variance of a random sample are independently distributed if and only if the parent population is normal. This characterization is used as a basis for developing a test termed Z-test for the composite hypothesis of normality. The simplicity of Z-test results from the computational ease and the clean form of the finite sample null distribution of the test statistic Z. It compares reasonably in power with several well known tests of normality and is particularly suitable for a joint assessment of normality. A routine for computing the statistic and its P-value is given. Author (GRA)

N77-31901# North Carolina Univ., Chapel Hill. Dept. of Statistics.
SPHERICALLY INVARIANT PROCESSES: THEIR NONLINEAR STRUCTURE DISCRIMINATION, AND ESTIMATION Interim Report
Steel T. Huang (Cincinnatti Univ.) and Stamatis Cambanis 1977 41 p refs
(Grant AF-AFOSR-2796-75)
(AD-A041458; AFOSR-77-0708TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The structure of the nonlinear space of a spherically invariant process is studied and the problem of discriminating between two spherically invariant processes as well as the problem of nonlinear estimation in spherically invariant processes are solved. Author (GRA)

N77-31902# Naval Postgraduate School, Monterey, Calif.
MEANS AND VARIANCES OF STOCHASTIC VECTOR PRODUCTS WITH APPLICATIONS TO RANDOM LINEAR MODELS
Gerald G. Brown and Herbert C. Rutemiller Feb. 1977 25 p refs
(AD-A041149; NPS55-77-6) Avail: NTIS HC A02/MF A01 CSCL 12/11

Many mathematical models in operations research require computation of products of vectors whose elements are random variables. Unfortunately, analytic results for functions of interest are only obtained through highly restrictive, often unrealistic, choices of prior densities for the vectors' elements. Often, an investigation is performed by discretizing the random variables at point-quantile levels, or by outright simulation. This paper addresses the problem of characterizing the inner product of two stochastic vectors with arbitrary multivariate densities. Expressions for means of variances of vector products are obtained, and used to make Tchebycheff-type probability statements. Included are applications to stochastic programming models. Author (GRA)

N77-31903# Illinois Univ., Urbana-Champaign.
VARIABLE-RATE, WEAKLY- AND STRONGLY - UNIVERSAL SOURCE CODINGS SUBJECT TO A FIDELITY CONSTRAINT Ph.D. Thesis
Kenneth Marsh Mackenthun, Jr. May 1977 69 p refs
(Contracts DAAB07-72-C-0259; NSF-ENG-75-20864)
(AD-A041686; RT-767; UILU-ENG-77-2214) Avail: NTIS HC A04/MF A01 CSCL 09/4

The goal of universal source coding is to find codes which

are efficient for sources with unknown or incompletely specified probability distributions; this is equivalent to finding codes which are efficient for a collection of sources. Previous work in universal variable-rate source coding subject to a fidelity constraint has assumed a prior probability measure on a collection of stationary ergodic sources. It is then shown that there is a single code which gives an average distortion D at an optimum rate, R sub theta (D), for most sources theta in the collection. This code is necessarily variable-rate since R sub theta (D) is not constant over the collection of sources. In this dissertation, new results are presented on coding a collection of stationary ergodic sources when no prior probability measure is assumed. In particular, it is shown that there exist variable-rate universal codes whose rate-distortion performance converges to the optimum attainable performance for each source in the collection. Two types of universal codes are considered in which the above convergence is pointwise (weakly-universal) or uniform (strongly-universal) over the collection of sources. It is assumed that there is a letter in the reproducing alphabet giving finite average distortion when used with each source in the collection and that sub R sub theta (D) over the collection of sources of finite. Strongly-universal codes are shown to exist for collections of finite alphabet memoryless sources and certain types of Markov sources. GRA

N77-31904# Loughborough Univ. of Technology (England). Dept. of Mathematics.
TRANSMISSION AND DESCRIPTION ZEROS
A. C. Pugh Feb. 1976 16 p refs
(Grant B-SR-8561)
(MATHS-Res-90) Avail: NTIS HC A02/MF A01

Several recent definitions of the zeros of a multivariable linear system are discussed and an attempt is made to establish a precise terminology. It is shown that upper bounds on the number of such zeros exist, which are multivariable analogues of the results for the classical scalar case of a proper transfer function. ESA

N77-31905# Wisconsin Univ., Madison. Dept. of Industrial Engineering.
A SEQUENTIAL PROCEDURE FOR DETERMINING THE LENGTH OF A STEADY-STATE SIMULATION
Averill M. Law and John S. Carson Apr. 1977 32 p refs
(Contract N00014-76-C-0403)
(AD-A040695; WP-77-12) Avail: NTIS HC A03/MF A01 CSCL 12/1

A common problem faced by simulators is that of constructing a confidence interval for the steady-state mean of a stochastic process. We have reviewed the existing procedures for this problem and found that they all produce confidence intervals with coverages which may be considerably lower than desired. Thus, in many cases simulators will have more confidence in their results than is justified. In this paper we present a new sequential procedure based on the method of batch means for constructing a confidence interval with coverage close to the desired level. Empirical results for a large number of stochastic systems indicate that the new procedure performs quite well. Author (GRA)

N77-31906# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mathematics and Statistics.
ESTIMATING A PROPORTION WHEN SAMPLING FROM A SUBPOPULATION
Samuel D. Oman 15 Apr. 1977 24 p refs
(Contract N00014-75-C-0529)
(AD-A040140; TR-28) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of estimating a population proportion when only a subpopulation may be sampled is considered. This is a simplified version of a problem which arises when testing for the association between a risk factor and a disease by analyzing contingency tables constructed from hospital data. The proportion for the subpopulation, which does not in general equal the population proportion, is expressed in terms of the population proportion and a nuisance parameter in such a way that the model is unfortunately not identifiable. A Bayesian procedure is developed which may be used, however, if one is willing to make certain assumptions about the nuisance parameter. As an illustration the procedure is used with a particular priori to obtain a posterior confidence interval for the population proportion. The coverage probabilities of the interval for various fixed values of the parameters are then evaluated. Author (GRA)

N77-31907# Arcon Corp., Wakefield, Mass.
INTERACTIVE MATH MODELING Final Report, 1 Oct. 1973 - 1 Sep. 1976
Stanley Woolf, John V. Brien, Edward Cohen, David Baker, and Jean Siung Feb. 1977 271 p refs
(Contract F19628-74-C-0049)
(AD-A040378; RADC-TR-77-86) Avail: NTIS HC A12/MF A01 CSCL 12/1

In this report, we will describe the techniques and computer programs developed to analyze various problems. The scope of our work extended into a variety of technical areas. A program was written to design a filter for analog-to-digital converted radar signals. The problem of low energy electron transport in irradiated solids was studied via four independent approaches: (1) an orders-of-scattering invariant imbedding calculation of transmitted and reflected scattered particle currents; (2) an iterative numerical solution for the one-dimensional Boltzmann equation for isotropic scattering. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-31908 Polish Academy of Sciences, Warsaw.
USE OF A DYNAMIC FLEXIBILITY MATRIX FOR IDENTIFICATION OF SYSTEMS OF n DEGREES OF FREEDOM [WYKORZYSTANIE MACIERZY PODATNOSCI DYNAMICZNEJ DO IDENTYFIKACJI UKLADOW O n STOPNIACH SWOBODY]
Jerzy Wicher 15 Nov. 1976 17 p refs In POLISH
Avail: Issuing Activity

A direct method is presented for utilizing the criterion of the smallest squares to determine parameters of a system. The regression analysis technique, which also employs the criterion of the smallest squares is utilized. A method of reducing a set of differential equations to regression equations is given and the dependencies between regression parameters and the parameter of the system are shown. In all cases, the concept of a dynamically flexible matrix is employed. Author

N77-31909*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADVANCES IN OPTIMAL ROUTING THROUGH COMPUTER NETWORKS
Israel M. Paz Washington Sep. 1977 19 p refs
(NASA-TR-R-475; JSC-S-446) Avail: NTIS HC A02/MF A01 CSCL 09B

The optimal routing problem is defined. Progress in solving the problem during the previous decade is reviewed, with special emphasis on technical developments made during the last few years. The relationships between the routing, the throughput, and the switching technology used are discussed and their future trends are reviewed. Economic aspects are also briefly considered. Modern technical approaches for handling the routing problems and, more generally, the flow control problems are reviewed. Author

N77-31910# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
FREQUENCY METHODS IN COMPUTER AIDED DESIGN OF CONTROL SYSTEMS M.S. Thesis
Stephen Christie Spielman Dec. 1976 118 p refs
(Contract DAAB07-72-C-0259; Grant AF-AFOSR-2570-73)
(AD-A040762; R-753; UILU-ENG-76-2241) Avail: NTIS HC A06/MF A01 CSCL 09/2

State space methods have served an important role in the development of modern control theory. They were originally proposed to help solve the increasingly complex aerospace control problems which frequency response methods of the time could not deal with. Historically this theory has led to a much greater understanding of the general nature of a system and to be

solution of a great variety of control problems. These means have further been applied to many other areas in the sciences, thus firmly establishing the importance of modern system studies. Author (GRA)

N77-31911# Defense Communications Engineering Center, Reston, Va. Systems Engineering Div.
A QUEUEING MODEL FOR A TECHNICAL CONTROL FACILITY
M. J. Fischer Mar. 1977 21 p refs
(AD-A040463; TN-5-77) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper develops a queueing model for one possible operating rule for a technical control facility. As suggested in one reference a military technical control facility can be considered as a multiserver queueing system. One possible operating rule, the situation where one and only one of the servers may periodically leave the facility, has not been considered previously in the queueing theory literature. This paper gives an exact analysis, as well as presenting several approximations, to the steady state behavior of the system. GRA

N77-31912# Georgia Inst. of Tech., Atlanta. Coll. of Industrial Management.
WHERE HAVE ALL THE MODERATORS GONE: THE PERILS OF TYPE II ERROR
Milton R. Blood and Gary M. Mullet May 1977 30 p refs
(Contract N00014-76-C-0828; NR Proj. 170-828)
(AD-A040598; GIT-M-77-5; TR-1) Avail: NTIS HC A03/MF A01 CSCL 12/2

Traditional moderated regression analysis requires a significant and sizable increment in R2 due to the interaction term in order to conclude that there is a moderator effect. A Monte Carlo analysis demonstrates that the traditional procedure will not discover moderators even when they are the only existing effect. A suggestion is made to reverse the usual hierarchical order of the moderated regression analysis. The choice between a linear and an interactive model should be made on the basis of theoretical justification. Author (GRA)

N77-31913# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF LOG-GAMMA AND LIEBERMAN-ROSS LOWER CONFIDENCE LIMIT PROCEDURES ON SYSTEM RELIABILITY M.S. Thesis
Teddy Ray Maynard Mar. 1977 96 p refs
(AD-A040199) Avail: NTIS HC A05/MF A01 CSCL 12/2

This thesis is an accuracy study of three empirical series system lower confidence limit procedures. Computer simulations were used to compare the accuracy of the procedures using the same set of data with 500 replications for each case. Modifications were then made to improve the accuracy of the Log-Gamma method. The systems simulated had reliabilities ranging from .6 to .95. They were composed of four, fifteen, or forty components and had component sample sizes of ten, twenty, or fifty. The Lieberman-Ross method was accurate but had high variance. The Log-Gamma method was conservative with small sample sizes, but became more accurate with increased testing. Randomization of the Log-Gamma method was the most successful of the modifications attempted. Author (GRA)

N77-31914# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
THE M/G/1 QUEUE WITH INSTANTANEOUS, BERNOULLI FEEDBACK
Ralph L. Disney and Donald C. McNickle Apr. 1977 19 p refs
(Contract N00014-75-C-0492)
(AD-A040555; TR-77-4) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is concerned with several random processes that occur within the class of M/G/1 queues with instantaneous feedback in which the feedback decision process is a Bernoulli process. Such systems in the case G=M are the simplest, non-trivial examples of Jackson networks. Indeed, they are so simple that they are usually dismissed from consideration in queueing network theory as being obvious. It will be shown that far from being obvious they exhibit some important, unexpected properties whose implications raise some interesting questions about Jackson networks and their application. In particular, Jackson observed that in his networks the vector valued queue length process behaved as if the component processes were independent, M/M/1 systems. Since those results appeared there has developed a mythology to explain them. These arguments usually rest on three sets of results that are well known in random point process theory: superposition, thinning, and stretching. By examining the network flow, it will be shown that the application of these results are inappropriate to queueing network with instantaneous, Bernoulli feedback. Their flows are considerably more complicated than one expects based on such arguments and one is left to ponder what the Jackson results mean to queueing network decomposition. GRA

N77-31915# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
CHARACTERIZATIONS OF POISSON TRAFFIC STREAMS IN JACKSON QUEUEING NETWORKS
Benjamin Melamed Mar. 1977 37 p refs
(Contract N00014-75-C-0492; Grant AF-AFOSR-2903-76)
(AD-A040554; TR-77-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

The equilibrium behavior of Jackson queueing networks (Poisson arrivals, exponential servers and Bernoulli switches) has recently been investigated in some detail. In particular, it was found that in equilibrium, the traffic processes on the so-called exit arcs of a Jackson network with single server nodes constitute Poisson processes. This result may be viewed as an extension of Burke's theorem from single queues to networks of queues. A conjecture made by Burke and others contends that the traffic processes on nonexit arcs cannot be Poisson in equilibrium. This paper proves this conjecture to be true for a variety of Jackson networks with single server nodes. Subsequently, a number of characterizations of the equilibrium traffic streams on the arcs of open Jackson networks emerge, whereby stochastic properties of traffic streams are shown to be equivalent to a simple graph-theoretic property of the underlying arcs. These results then help to identify some inherent limitations on the feasibility of equilibrium decompositions of Jackson networks.
Author (GRA)

N77-31916# California Univ., Berkeley. Operations Research Center.
COHERENT SYSTEMS WITH MULTI-STATE COMPONENTS
Richard E. Barlow Jan. 1977 19 p refs
(Contract N00014-75-C-0781; Grant AF-AFOSR-3179-77)
(AD-A041094; ORC-77-5) Avail: NTIS HC A02/MF A01 CSCL 12/2

The theory of binary coherent systems is generalized for multi-state components. The system state is defined to be the state of the worst component in the best min path, or equivalently, the state of the best component in the worst min cut. All of the results for the binary case can be computed for multi-state systems using the binary structure and reliability function concepts. Monotonicity results are now valid with respect to stochastic ordering of component probability vectors. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-31917 Houston Univ., Tex.
STRUCTURE SEMIGROUPS OF CONVOLUTION MEASURE ALGEBRAS Ph.D. Thesis
Charles B. Hoffman 1976 75 p
Avail: Univ. Microfilms Order No. 77-10108

A brief outline is given for obtaining the structure semigroup S(M) of a convolution measure algebra M, in which the underlying topological space is the maximal ideal space of the norm closure of the linear span of delta M, the complex homomorphisms on M. The multiplication in the structure semigroup of M is shown to be induced, in a natural manner, by the Arens product on M.
Dissert. Abstr.

N77-31918# Naval Postgraduate School, Monterey, Calif.
NECESSARY CONDITIONS FOR PROBLEMS WITH HIGHER DERIVATIVE BOUNDED STATE VARIABLES Final Report, Apr. - Jun. 1975 and Jan. - Mar. 1976
I. Bert Russak Jun. 1977 49 p refs
(AD-A041635; NPS-53RU77061) Avail: NTIS HC A03/MF A01 CSCL 09/4

A set of necessary conditions is obtained for the general control problem of Bolza with state inequality constraints in which the control enters in the second derivative of the constraint. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-31919# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
[RESEARCH ACTIVITIES OF THE NATIONAL COLLEGE OF ADVANCED TECHNOLOGY] Annual Report, 1975 [RAPPORT D'ACTIVITE SUR LES RECHERCHES A L'ENSTA EN 1975]
1976 85 p refs In FRENCH Original contains color illustrations
Avail: NTIS HC A05/MF A01

Research and development in the fields of chemistry, optical informatics, plasma physics, applied optics, hydrodynamics, thermodynamics, interface phenomena, and materials and structures are presented. ESA

N77-31920# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
SCATTERING OF SOFT X-RAYS BY DUST PARTICLES [UNTERSUCHUNGEN DER STREUUNG WEICHER ROENTGENSTRAHLEN AN STAUBKOERNERN]
Wolfgang Burkert Dec. 1976 98 p refs In GERMAN
(MPI-PAE/Extraterr-130; ISSN-0340-8922) Avail: NTIS HC A05/MF A01

X-ray scattering in the energy range from 0.25 to 1.5 keV by dust particles having a radius between 0.1 and 0.6 micron was investigated experimentally. It was found that the scattering distribution can be explained from the Rayleigh-Gauss approximation, at least for aluminum and graphite particles. The particle radius, the particle size distribution and the complex refractive index appeared to have a great influence on the scattering distribution. ESA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-31921# Washington Univ., Seattle. Dept. of Electrical Engineering.
GUIDED WAVES IN ALKALI-HALIDE FILMS
Andreas K. Richter Dec. 1976 21 p refs
(Contract N00014-76-C-0522; NR Proj. 350-005)
(AD-A036495; UW-TR-201) Avail: NTIS HC A02/MF A01 CSCL 20/6

The feasibility of building writable and erasable waveguides and thin film optical elements in photodichroic materials was examined. The studies involved consideration of controllable deflection or focal length using the photodichroism of color centers in alkali-halide crystals. Material properties limiting the ultimate application and areas needing further research were identified. GRA

N77-31922# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
SELECTION OF MINIMUM DAY/NIGHT LEVELS FOR NOISEMAP CONTOUR CALCULATIONS
Dwight E. Bishop Nov. 1976 15 p
(Contract F33615-76-C-0507; AF Proj. 7231)
(AD-A040623; BBN-10189; AMRL-TR-76-124) Avail: NTIS HC A02/MF A01 CSCL 01/5

This report discusses guidelines for the minimum Day/Night Level (DNL) values that should be used with NOISEMAP type computations to: (1) insure adequate accuracy of the lowest contour level for a given set of aircraft operations; and (2) minimize the number of machine computations and thereby reduce operating costs. An analysis is made of the errors introduced in the DNL contour values due to truncation of the partial DNL cutoff determined by the single event noise level or the number of aircraft operations for a particular flight path. For a given airbase and fixed volume of aircraft operations, the cutoff occurs at higher single event noise levels as the number of aircraft flight paths or aircraft classes are increased. Finer detail in describing the aircraft operations results in the cutoff noise levels being raised with an increased error at the edges of the DNL grid computations, but with a corresponding decrease in the machine running time. These DNL cutoff guidelines have been incorporated into version 3.4 of NOISEMAP. Author (GRA)

N77-31923# Rome Air Development Center, Griffiss AFB N.Y.
TEMPERATURE COMPENSATED CUTS OF BERLINITE AND BETA-EUCRYPTITE FOR SAW DEVICES
Robert M. OConnell and Paul H. Carr 1977 6 p refs Presented at Proc. of 31st Ann. Symp. on Frequency Control, 1-3 Jun. 1977
(AD-A040609; ETR-77-0016) Avail: NTIS HC A02/MF A01 CSCL 20/1

Calculations of the surface acoustic wave (SAW) properties of berlinite (AlPO4) and beta-eucryptite (beta-LiAlSiO4) show that both materials are temperature compensated along both singly rotated and doubly rotated orientations. For berlinite, several orientations combine zero electromechanical power flow angles with more than four times the piezoelectric coupling of ST cut quartz. The best singly rotated orientation is a direct analog of the ST cut of quartz. This cut has, like ST quartz, a zero electromechanical power flow angle, but the distinct advantage of more than four times the piezoelectric coupling. For beta-eucryptite, a singly rotated orientation has a SAW velocity of 3662 m/sec and almost twice the piezoelectric coupling of ST cut quartz, but the disadvantage of an electromechanical power flow angle of 18 degrees. The results for berlinite show that it represents an attractive alternative to quartz for use in broadband, low insertion loss SAW devices. The relatively low piezoelectric coupling of beta-eucryptite makes it unattractive for broadband, low insertion loss applications, but its relatively large SAW velocity indicates that it may be useful in high frequency applications. GRA

N77-31924# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AEROACOUSTIC ENVIRONMENT OF A STORE IN AN AIRCRAFT WEAPONS BAY Final Report, Oct. 1971 - Jan. 1976
L. L. Shaw and D. L. Smith Mar. 1977 64 p refs
(AD-A041263; AFFDL-TR-77-18) Avail: NTIS HC A04/MF A01 CSCL 01/1

Flight tests were performed in which the sound pressure level distribution on the surface of a store was measured. The store was installed in the weapons bay of an F-111 aircraft and was flown at Mach numbers between 0.7 and 1.3 for altitudes of 3,000, 10,000, and 30,000 feet. Constant Mach number flights as well as accelerated ones were performed. There was a total of 21 microphones installed on the surface of the store. The resulting data from the microphones were used to determine equal level sound pressure level contours for the entire surface of the store. These contours revealed that the levels increase fairly uniformly for the first one-third of the store and then for the remainder of the surface they display areas of maximum and minimum sound pressure levels. For prediction purposes the contours were normalized and one general contour shape was developed. Also, a general spectrum shape is presented which gives the frequency distribution of the energy. Comparisons to past data showed good results. Author (GRA)

N77-31925# Yale Univ., New Haven, Conn.
BISTATIC SURFACE SCATTERING STRENGTH AT SHORT WAVELENGTHS Final Report, 1 Apr. 1976 - 31 Mar. 1977
John G. Zornig, Peter M. Chultheiss, and Jacqueline Snyder Jun. 1977 95 p refs
(Contract N00014-75-C-1014)
(AD-A041316; CS-9) Avail: NTIS HC A05/MF A01 CSCL 20/1

A series of measurements of the scattering strength of a wind driven water surface at 1.3 mHz have been made. The measurements have been made at 12 degree and 17 degree grazing angles, bistatic azimuths ranging from 0 degrees to 180 degrees, and two different surface roughness conditions. Orientations with respect to the wind over a range of 180 degrees were used. The measurements were made with short, relatively narrow band probing signals under computer control. The data were converted to scattering strength using a flat surface reference and a compensation for beam patterns and source and receiver timing. The results of these measurements indicate that wind direction is an important factor in determining reverberation from the surface. Surface roughness was found to be important, but the scalar Rayleigh Parameter is found not to be a useful indicator of reverberation level. Grazing angle and acoustic wavelength were found to be relatively insignificant variables. The results obtained in this series of experiments indicate that present theory will not predict scattering strength accurately without a detailed knowledge of the second order spatial statistics of the surface. Efforts to obtain measurements of surface slopes of the required precision have met with very limited success but will continue. Author (GRA)

N77-31926# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
THE MEAN FLOW EFFECT ON THE ACOUSTIC IMPEDANCE OF A RECTANGULAR PANEL
Yi Mason Chang Feb. 1977 152 p refs
(Contract N00014-75-C-0509)
(AD-A041268; A/V-82464-1) Avail: NTIS HC A08/MF A01 CSCL 20/11

In better understanding the coupling between a vibrating panel and its surrounding acoustic medium, a precise knowledge of both the real and the imaginary parts of the radiation impedance is of critical value. The modal radiation impedance of a rectangular panel simply supported in an infinite baffle in the presence of an inviscid, uniform, subsonic flow is studied. The analysis is based on an expansion in normal modes of the transverse vibration displacement field of transforms. These are used to formulate the expressions for the modal radiation impedance, and the cross modal coupling impedance. A computer program was formulated to evaluate the modal radiation impedances. A modified Chebychev quadrature served as a major ingredient. Experiments performed were compared with the analytical results. Some experiments showed larger increases in the panel radiation resistance due to flow speed than would be predicted by the present linear theory. Author (GRA)

N77-31927# European Space Agency, Paris (France).
SOUND ATTENUATION IN MULTIPLY LINED RECTANGULAR DUCTS INCLUDING THE EFFECTS OF THE WALL IMPEDANCE DISCONTINUITIES. PART 2: LINERS IN PARALLEL
Werner Koch Aug. 1977 50 p refs Transl. into ENGLISH of 'Schalldaempfung bei Mehrfachauskleidungen im Rechteckkanal unter Beruecksichtigung der unstetigen Aenderungen der Wandimpedanz', DFVLR, Goettingen, West Ger. Report DLR-FB-76-58, 11 Nov. 1976 Original report in GERMAN previously announced as N77-25917 Original GERMAN report available from DFVLR, Cologne DM 21,60
(ESA-TT-399-Pt-2; DLR-FB-76-58-Pt-2) Avail: NTIS HC A03/MF A01

The problem of sound attenuation by two sound absorbing liners of finite length with different wall impedance on the opposite sides of an infinitely long rectangular duct is formulated initially for a duct with no through flow, as a Wiener-Hopf problem. A system of two coupled, generalized Wiener-Hopf equations is obtained, the solution of which is obtained for a realistic wall impedance model. The influence of various liner parameters on the sound attenuation is displayed graphically. It is shown that a parallel arrangement (as well as a series arrangement) is practicable as an efficient means of obtaining broad band attenuation. Author (ESA)

N77-31928# Georgetown Univ., Washington, D.C. Dept. of Physics.
SONIC REFLECTION FROM AN ICE PLATE IN SEA WATER Technical Report, 1 Nov. 1976 - 30 Apr. 1977
Walter G. Mayer, Peter H. Huang, Leslie E. Pitts, and Thomas J. Plona 17 May 1977 31 p
(Contract N00014-75-C-0333)
(AD-A039868; GUUS-05777; TR-7) Avail: NTIS HC A03/MF A01 CSCL 20/1

Plane wave reflection coefficient for a water/sea-ice/air interface is calculated from solution of plate mode equations of this system. General theory of nonspecular reflection effects are given for bounded beams reflected from solid plate in a liquid. Author (GRA)

N77-31929# Texas Univ., Austin. Applied Research Labs.
THE SUPPRESSION OF SOUND BY SOUND OF HIGHER FREQUENCY Interim Report
William L. Willshire, Jr. May 1977 140 p refs
(Contracts F44620-76-C-0040; N00014-75-C-0867)
(AD-A040008; ARL-TR-77-22; AFOSR-77-0656TR)
HC A07/MF A01 CSCL 20/1

The purpose of this research was to study the suppression of one sound by another sound of higher frequency. More specifically, the planar propagation in air of a finite amplitude tone (the pump) and a smaller amplitude tone (the weak signal) of lower frequency was investigated both theoretically and experimentally. Suppression is caused by an acoustic modulation process. The amount of suppression depends qualitatively on whether the pump frequency is lower than the weak signal frequency (Case I) or vice versa (Case II). Case I has been previously studied and large suppression of the weak signal has been obtained. Even though preliminary analytical work indicated that little suppression is possible in Case II, the present research was undertaken to determine the amount of suppression possible. Various exact and approximate preshock solutions were reviewed in the time domain (Earnshaw solution) and frequency domain (Fenlon solution). Postshock solutions were based on weak shock theory which was implemented in a computer algorithm, corrections for attenuation and dispersion were incorporated. Predictions thus obtained were compared to experimental results. The experiments, performed in a 30 m progressive wave tube, were restricted to Case II. The agreement between experimental results and theoretical predictions was excellent. In particular the experiments confirmed the theoretical prediction that little suppression of the weak signal is obtained for Case II either before or after shock formation. The sidebands in both cases form around the high frequency and its harmonics. GRA

N77-31930# Manlabs, Inc., Cambridge, Mass.
NOISE ABATEMENT AND INTERNAL VIBRATIONAL ABSORPTION IN POTENTIAL STRUCTURAL MATERIALS Final Report, 30 Nov. 1973 - 31 Dec. 1976
L. Kaufman, S. A. Kulin, and P. P. Neshe Feb. 1977 240 p refs
(Contract DAAG46-74-C-0048; ARPA Order 2555)
(AD-A040029; AMMRC-CTR-77-9) Avail: NTIS HC A11/MF A01 CSCL 20/1

Efforts were directed toward identifying potential structural materials which combine high strength with damping characteristics in the audible range. The range of yield strengths and loss factors which are attainable exceed currently available commercial materials. Measurements of the enthalpy of transformation in a thermoelastic Cu-Al-Ni alloy have been conducted over a range of grain size and sample size to assess the stored elastic strain energy. Studies of the magnetic domain wall configuration in a cobalt-iron alloy have been carried out to evaluate the contribution of domains to damping in this alloy. The hull of a one-sixth scale dynamic model of an armoured personnel carrier was fabricated from a high-damping iron-chromium-aluminum alloy and was evaluated over a range of vibrational frequencies simulating operation. A torpedo propeller was cast from a high damping cobalt-iron alloy and evaluated in underwater vibration tests. GRA

N77-31931# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ADVANCED SURFACE ACOUSTIC WAVE (SAW) OSCILLATOR INVESTIGATION Final Report, 1 Feb. 1976 - 1 Feb. 1977
Apr. 1977 56 p
(Contract N00123-76-C-0588)
(AD-A040436) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the results of the development, fabrication, evaluation, and test performed on Advanced Surface Acoustic Wave (SAW) Oscillators. The main purpose of the SAW oscillator program was the fabrication and characterization of SAW oscillators operating at 250 MHz, 500 MHz, and 1 GHz. As the data presented shows, the performance of these oscillators closely approaches or exceeds the current state-of-the-art in nearly every respect. GRA

N77-31932# Texas Univ., Austin.
A SENSITIVITY STUDY OF UNDERWATER SOUND PROPAGATION LOSS AND BOTTOM LOSS
Kenneth E. Hawker, Karl C. Focke, and Aubrey L. Anderson 28 Feb. 1977 125 p refs
(Contract N00039-C-0003)
(AD-A041378; ARL-TR-77-17) Avail: NTIS HC A06/MF A01 CSCL 20/1

This report describes the techniques used and results obtained in a model study of the sensitivity of propagation loss to variations in bottom loss and bottom loss to variations in the geoacoustical models of the subbottom. The propagation loss sensitivity study was carried out, using both ray and wave propagation models, for a variety of source-receiver depth combinations and with various sound speed profile types. The bottom loss sensitivity study was carried out using a model developed by Applied Research Laboratories (ARL), The University of Texas at Austin, and is concentrated on addressing questions of hidden depths, substrate effects, and sound speed and density profile effects. Author (GRA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-31933# National Bureau of Standards, Washington, D. C.
RADIATION PHYSICS
A. M. Ghose, ed. (Bose Inst. Calcutta, India), D. V. Gopinath, ed. (Reactor Research Center, Kalpakkam, India), J. H. Hubbell, ed., and S. C. Roy, ed. (Bose Inst., Calcutta, India) Jan. 1977 267 p refs Proc. of the Intern. Symp. on Radiation Phys., Calcutta, 30 Nov. - 4 Dec. 1974 Sponsored in part by Bose Inst., Calcutta; Dept. of Atomic Energy India; Intern. Atomic Energy Agency, and NBS
(NBS-SP-461; LC-76-608379) Avail: NTIS MF A01; SOD HC $3.25 as C13.10:461

The proceedings of the International Symposium on Radiation Physics held at the Bose Institute, Calcutta, India Nov. 30-Dec. 4, 1974 are presented. Topics include new measurements, theoretical developments, compilations and applications of basic cross section and transport data for photon, electron, neutron and heavy ion beams interacting with matter. Author

N77-31934*# Oregon Univ., Eugene. Dept. of Physics.
PHOTON SCATTERING CROSS SECTIONS OF H2 AND He MEASURED WITH SYNCHROTRON RADIATION
Gene E. Ice [1977] 35 p refs
(Grants NGR-38-003-036)
(NASA-CR-155010) Avail: NTIS HC A03/MF A01 CSCL 20H

Total (elastic + inelastic) differential photon scattering cross sections have been measured for H2 gas and He, using an X-ray beam. Absolute measured cross sections agree with theory within the probable errors. Relative cross sections (normalized to theory at large S) agree to better than one percent with theoretical values calculated from wave functions that include the effect of electron-electron Coulomb correlation, but the data deviate significantly from theoretical independent-particle (e.g., Hartree-Fock) results. The ratios of measured absolute He cross sections to those of H2, at any given S, also agree to better than one percent with theoretical He-to-H2 cross-section ratios computed from correlated wave functions. It appears that photon scattering constitutes a very promising tool for probing electron correlation in light atoms and molecules. Author

N77-31935# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN APPROACH TO THE ANALYSIS OF VIBRATIONAL-ROTATIONAL INTERACTIONS IN MOLECULES Final Report, 1 Dec. 1975 - 30 Jun. 1976
Richard Barakat, Shepard A. Clough, and Lawrence Rothman Sep. 1976 32 p refs
(Contract F19628-76-C-0114)
(AD-A039895; AFGL-TR-76-0277) Avail: NTIS HC A03/MF A01 CSCL 07/4

The vibration-rotation interaction of diatomic molecules with high angular moments have been completely re-examined using a nonperturbative scheme which avoids the usual anharmonic oscillator interpretation. A second section is devoted to the evaluation of the mass-dependent contribution to the potential energy in the Watson version of the vibration-rotation Hamiltonian in terms of the generalized Lucas polynomials. The third section of the report discusses an attempt to employ Chebyschev operator expansions to the Van Vleck transformation. Author (GRA)

N77-31936# Air Force Geophysics Lab., Hanscom AFB, Mass.
VIBRATIONAL EXCITATION OF CARBON DIOXIDE AND CARBON MONOXIDE BY HIGH VELOCITY COLLISION WITH MOLECULAR OXYGEN
A. Rahbee, James J. Gibson, and Charles P. Dolan 26 Jan. 1977 28 p refs
(AD-A040779; AFGL-TR-77-0025; AFGL-ERP-591) Avail: NTIS HC A03/MF A01 CSCL 20/8

A hyperthermal molecular beam apparatus, utilizing a heated seeded supersonic nozzle capable of producing fast intense beams of atmospheric species, has been employed to study vibrational excitation of plume species carbon dioxide and carbon monoxide. The apparatus is provided with a novel neutral beam detector for measurement of beam intensity and velocity distribution. The excitation mechanism is studied through monitoring of the infrared emission from the plume species by the use of lead sulfide, lead selenide, and indium antimonide. Lack of measurable signals is analyzed in terms of signal to noise ratios and it is shown that excitation cross sections generally have an upper limit of 10 to the 19th power per square centimeter showing that transfer of translational energy into internal energy does not take place efficiently. Author (GRA)

N77-31937# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
STATISTICS OF ONE-DIMENSIONAL CLUSTER MOTION
John D. Wrigley, David A. Reed, and Gert Ehrlich Mar. 1977 54 p refs
(Contract DAAB07-72-C-0259; Grant NSF-DMR-72-02937)
(AD-A040686; R-763; UILU-ENG-77-2210) Avail: NTIS HC A04/MF A01 CSCL 20/10

The statistics of clusters, made up of metal atoms in adjacent one-dimensional diffusion channels, are developed quantitatively. Kolmogorov's equation is used to find the mean square displacement for clusters capable of existing in energetically different configurations at the same displacement of the center of mass; this is done under steady state conditions, for which the probability of finding a specified configuration does not vary in time. Two systems are examined; (1) Dimers capable of existing in an infinite number of states, a situation realized if dissociation is allowed, and (2) Trimers diffusion on planes, such as W(211), on which nine distinct jump processes may contribute to the motion. In dimer diffusion, it is demonstrated that dissociation may be important even if the fraction dissociated is minor. For trimers, previous attempts to approximate the motion through the use of average transition rates are compared with the exact solutions and found wanting. Important statistical quantities beyond the mean square displacement are presented for simple dimers, capable of existing in only two states. GRA

N77-31938# United Technologies Research Center, East Hartford, Conn.
AIR MOLECULAR COMPUTATION STUDY Final Draft Report, 1 Jun. 1976 - 30 Jan. 1977
H. Harvey Michels 30 Mar. 1977 74 p refs
(Contract F19628-76-C-0265)
(AD-A040933; AFGL-TR-77-0032) Avail: NTIS HC A04/MF A01 CSCL 20/8

Research was directed toward the calculation of the electronic structure and radiative transition probabilities for NO(+). Ab initio methods, employing configuration interaction (CI), were utilized. Author (GRA)

N77-31939# California Univ., Livermore. Lawrence Livermore Lab.
CHARGE TRANSPORT PROBLEM
Edward P. Lee 11 Jan. 1977 11 p ref
(Contract W-7405-eng-48; DON-NAOR-11-76)
(UCID-17380) Avail: NTIS HC A02/MF A01

An investigation of relativistic particle beam in a semi-infinite axially symmetric conducting channel extending from a perfectly conducting plane, demonstrated that the net charge transported by a beam pulse injected into a channel of finite conductivity equals the charge of the beam itself. The channel is taken to be infinite in the positive z direction, has finite radius and is terminated by a conducting ground plane at z = 0. This result is not an obvious one, and is restricted in its applicability by the special model assumed for the channel. Results are expressed in more qualitative terms and similar calculations using several other channel models are made. These calculations are not concerned with the fate of the transported charge after the pulse has stopped, but rather with how much charge leaves the ground plane assuming the pulse does not stop. ERA

N77-31940# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A NUMERICAL INTEGRATION SCHEME FOR ITERATIVE CALCULATIONS ON ATOMIC SYSTEMS
M. Blakemore, G. A. Evans, and J. Hyslop Mar. 1976 28 p refs
(MATHS-Res-93) Avail: NTIS HC A03/MF A01

A recursive numerical integration scheme based on the method of Clenshaw and Curtis is proposed for the efficient implementation of the variation-iteration procedure for the computation of approximate energies and wave functions for complex atomic systems. Details of a suitable integration scheme are presented which will form the basis of the work on more complex systems such as lithium and beryllium. The efficiency and stability of the scheme are assessed and comparisons made with earlier proposals, representative tests being carried out on certain physical systems. Author (ESA)

N77-31941# Georgetown Univ., Washington, D.C. Dept. of Chemistry.
TRANSIENT INTERACTIONS IN SOLUTION BY INTERMOLECULAR SPIN COUPLING Final Report, 19 Jan. 1976 18 Jan. 1977
Richard D. Bates, Jr. 28 Feb. 1977 24 p refs
(Grant DAAG29-76-G-0132)
(AD-A039867; ARO-13557.3-R-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

Experimental work on the promotion of spin information transmission from solute to solvent species by chlorine atoms was continued. The role of partioning in ternary solutions has been investigated by observing (2)H, (1)H, (31)P, and (7)Li low-field NMR. The use of nitroxide spin labels to tag silanol groups on the surface of various silicon oxide materials has been examined. Experimental and theoretical work describing the intermolecular coupling of the solute and solvent spin systems was extended to very low spin label concentrations. GRA

N77-31942# City Coll. of the City Univ. of New York. Dept. of Physics.
KINETIC THEORY DESCRIPTION OF ELECTRON STIMULATED DESORPTION
Richard Janow and Narkis Tzoar 30 Jun. 1977 37 p refs
(Contract N00014-75-C-0949)
(AD-A042069) Avail: NTIS HC A03/MF A01 CSCL 07/4

A first principles kinetic theory is developed, applicable to angular dependent emission in Electron Stimulated Desorption. Expressions for the ionic and neutral atom ESD cross sections are formulated and applied in a model calculation of O- emission from W(111). Strong focussing of the outgoing ions was found, with the use of a model ion-solid potential in which the substrate was free of excitation. Off-axis spot groups were simulated. The peak ion energies obtained with this model are, however, small compared to experimental energies for the high coverage case. The need to introduce substrate excitations to describe this case is discussed. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N77-31943# California Univ., Livermore. Lawrence Livermore Lab.
INTENSE NEUTRON SOURCE FACILITY Progress Report, 1 Oct. - 31 Dec. 1976
M. C. Brown, comp. Feb. 1977 28 p refs
(Contract W-7405-eng-36)
(LA-6702-PR) Avail: NTIS HC A03/MF A01

Progress in the construction of the Beam-on-Target (B-O-T) prototype test facility is reported. Particularly encouraging is the progress made with the annular-type duoplasmatron. Improvement in filament conditioning procedures has led to very stable multiple-arc operations. The question of beam neutralization is being addressed as it applies to the design of both B-O-T transport and intense neutron source (INS) transport equipment. Standard circuits and practices are being developed for all computerized linear data and control channels for B-O-T and INS instrumentation. Operation of a mock-up differential pumping system produced expected results for air. The prototype isotope separator system has been successfully operated, using a ternary mixture of hydrogen, hydrogen deuteride, and deuterium. The supersonic jet target experiments have been extended, as well as studies to determine 14-MeV neutron shielding requirements. ERA

N77-31944# Battelle Pacific Northwest Labs., Richland, Wash.
ENVIRONMENTAL ANALYSIS OF FUSION POWER TO DETERMINE RELATED R AND D NEEDS
J. R. Young Nov. 1976 66 p refs
(Contract E(45-1)-1830)
(BNWL-2010) Avail: NTIS HC A04/MF A01

A brief description of the technical background of fusion is given. Environmental effects are considered in terms of construction effects, fuel cycle impacts, and operational impacts. Some operational effects considered are: personnel requirements, waste heat, chemical releases, sanitary wastes, noise and vibration, odors, magnetic fields, nonradioactive liquid releases, nonradioactive solids, routine tritium releases, nontritium radioactive waste, aesthetic impacts, socioeconomic impacts, and transportation impacts. ERA

N77-31945# Little (Arthur D.), Inc., Cambridge, Mass.
GAS COOLED REACTOR ASSESSMENT, VOLUME 1 Final Report, 9 Feb. - 30 Jun. 1976
Aug. 1976 143 p refs Prepared in cooperation with United Constructors and Engrs., Inc., Philadelphia
(Contract EY-76-C-02-2885)
(TID-27424/1-Vol-1) Avail: NTIS HC A07/MF A01

The development and commercialization of the following four reactor types were studied: high temperature gas-cooled reactor-steam cycle, direct conversion high temperature reactors, very high temperature reactors, and gas-cooled fast breeder reactors. The areas of research were as follows: (1) a technical and economic assessment of the status of the different reactor types was performed; (2) a spectrum of scenarios was developed projecting the performance of the reactor types, their areas of potential application and schedule of commercial availability; (3) alternative scenarios were developed for providing required

electrical energy within the United States; and (4) commercial deployment strategies for gas-cooled reactors were provided. ERA

N77-31946# Combustion Engineering, Inc., Windsor, Conn.
ASSESSMENT OF THORIUM FUEL CYCLES IN PRESSURIZED WATER REACTORS Final Report
N. L. Shapiro, J. R. Rec, and R. A. Matzie Feb. 1977 210 p refs
(EPRI Proj. 515-1)
(EPRI-NP-359) Avail: NTIS HC A10/MF A01

Alternate thorium fuel cycles were evaluated on a consistent basis to provide a comparison of resource utilization with the conventional uranium cycle and with more advanced concepts. The economic motivation and the technical feasibility of employing thorium-based fuels in present pressurized water reactors were also determined. Increases in energy generation for highly-enriched uranium/thorium fuel cycles are obtained at the expense of higher separative work requirements (about 25 percent) and higher uranium ore requirements during the early cycles. Cycles employing plutonium enrichment have a more limited long term impact on uranium ore utilization because of the large fraction of the nuclear generating capacity which must be operated on the conventional uranium cycle to provide start-up and makeup plutonium inventories. However, about 20 percent more energy can be generated per kilogram of plutonium consumed in the thorium cycle than in the uranium cycle, and hence the thorium-based cycle represents a superior way of utilizing existing plutonium stockpiles. ERA

N77-31947# California Univ., Livermore. Lawrence Livermore Lab.
MATHEMATICAL MODELS DESCRIBING GENERATION AND DIFFUSION OF TRITIUM AND HELIUM-4 IN SOLID BREEDERS FOR FUSION REACTORS
R. M. Alire and S. A. Steward 8 Feb. 1977 14 p refs
(Contract W-7405-eng-48)
(UCRL-52212) Avail: NTIS HC A02/MF A01

Several mathematical models, based on spherical geometry, were developed to describe generation, accumulation, and release of He and T2 in solid breeders for fusion reactors. The applicability of these models was extended to include a collection of particles that have a log-normal distribution. An assessment of the models focused attention on the fact that there is a paucity of data on the diffusion coefficients and solubilities of hydrogen isotopes and helium-4 in solid breeders. For high generation rates, the limiting concentrations of helium-4 and tritium may exceed their solubilities in solid breeders, and bubbles could form. These bubbles could be accommodated by swelling without rupturing. In some cases the forces imparted by trapped gases may be sufficient to rupture the sphere. In other cases new exit paths for these gases, such as grain boundary separations, cracks, or fissures, could form. ERA

N77-31948# Oak Ridge National Lab., Tenn. Chemical Technology Div.
CARBON-14 PRODUCTION IN NUCLEAR REACTORS
Wallace Davis, Jr. Jan. 1977 38 p refs
(Contracts W-7405-eng-26)
(ORNL/NUREG/TM-12) Avail: NTIS HC A03/MF A01

Detailed estimates are presented of the amounts of C14 formed in LWRs, HTGR, and LMFBR with emphasis on those pathways that are likely to lead to the release of this nuclide, either at the reactor site or at the fuel reprocessing plant. ERA

N77-31949# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DISPLACEMENT DAMAGE IN SILICON IRRADIATED WITH 6-TO-10 MeV NEUTRONS
J. E. Youngblood, W. R. VanAntwerp, and R. M. Tapphorn Apr. 1977 38 p refs
(AD-A039774; BRL-MR-2738) Avail: NTIS HC A03/MF A01 CSCL 18/8

Some preliminary experimental and theoretical results on the energy dependence of neutron-induced displacement damage in silicon are presented. The reduction in carrier lifetime, as reflected in the change in forward voltage at a fixed injection level, has been measured in wide-base silicon diodes, for monoenergetic neutrons at selected energies between 5.6 and 9.8 MeV. Twenty-five measurements at 19 energies were made. To calculate the variations in damage with neutron energy, a computer program that could utilize all details of the best available neutron cross section data was prepared. This program accepts coefficients for a Legendre polynomial fit of a partial cross section, determines the silicon recoil energy at a particular angle, and calculates the Lindhard fraction of energy for displacement damage. The calculated results provide a direct indication of the effect of angular distributions and the sensitivity of damage calculations to various details of the input neutron cross sections. Author (GRA)

N77-31950# Oregon State Univ., Corvallis. Dept. of Nuclear Engineering.
EVALUATION OF FISSION PRODUCT AFTERHEAT Quarterly Report, 1 Oct. - 31 Dec. 1976
B. I. Spinard Jun. 1977 75 p
(Contract AT(49-24)-0157)
(PB-267578/3; NUREG-0018-5; NRC-3) Avail: NTIS HC A04/MF A01 CSCL 18G

Specific tasks covered are: (1) re-examination of fission product yield uncertainties to be used as input to merging sensitivity calculations; (2) a tabulation of recommended uncertainties on fission product decay energies to accompany the decay energy of ENDF/B-IV; (3) a description of the ROPEY computing system; and (4) a reduction of ORNL decay heat data to pulse irradiation conditions and the merging into it of reliable older data of reasonable quality. The Oak Ridge experiment dominates the final results. GRA

74 OPTICS

Includes light phenomena.

N77-31951# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences.
THE FORMATION AND OPTIMIZATION OF INTERFEROMETRIC FRINGES
Benjamin J. Pernick and Kenneth G. Leib Sep. 1977 36 p refs
(RM-642) Avail: NTIS HC A03/MF A01

Expressions to describe fringe contours in the region of interference of two coherent beams are derived for three combinations of plane and spherical wave geometries. The fringe contrast ratio is shown to be spatially variable whenever spherical wavefronts are involved and can be controlled by altering the reference to signal beam intensity ratio. These expressions can be applied during the fabrication of matched filters or holographic lenses. Author

N77-31952# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DIGITAL PROCESSING OF AIRCRAFT IMAGES TO EXACT SILHOUETTES
G. Gardner, J. Mendelsohn, and M. Wohlers Jul. 1977 52 p refs
(RM-640) Avail: NTIS HC A04/MF A01

Aircraft can be reliably identified by silhouettes extracted from digitized optical images of model aircraft; four major aspects of aircraft optical imaging were studied. This investigation: (1) used real aircraft images with full gray scale illumination, (2) studied the effects of background noise and clutter, (3) studied the effects of sensor-induced noise, and (4) applied such techniques to nonoptical imagery. Author

N77-31953# Naval Research Lab., Washington, D. C.
OPTICAL PULSE SQUARING EFFECTS IN A DISPERSIVE DELAY LINE Interim Report
R. H. Lehmberg, J. Reintjes, and R. C. Eckardt May 1977 14 p refs
(AD-A040982; NRL-MR-3525) Avail: NTIS HC A02/MF A01 CSCL 20/6

Temporal squaring effects are produced using a pair of diffraction gratings on 30 p/sec duration 1.06 micrometer pulses that were negatively self phase modulated in cesium vapor. The

results are in good agreement with the theory, which is discussed in detail. Further enhancement of the squaring by a saturable absorber is also discussed. GRA

N77-31954# Harris Corp., Melbourne, Fla. Electronic Systems Div.
FIBER OPTICS DESIGN AID PACKAGE Final Technical Report
I. B. Slayton, D. J. Estapa, J. R. Jones, and C. R. Patisaul Griffiss AFB, N. Y. RADC May 1977 207 p refs Supplement to RADC-TR-77-163
(Contract F30602-76-C-0246)
(AD-A040772; RADC-TR-77-163) Avail: NTIS MF A01 CSCL 20/6

This report contains a computer based program which will provide for system level and component level performance analysis for point to point fiber optic communication links. It enables the user to optimize various aspects of a fiber optic communication link for either analog or digital transmission. Author (GRA)

N77-31955# Baird-Atomic, Inc., Bedford, Mass.
TEST AND EVALUATION OF NIGHT VISION OPTICAL SYSTEMS: THIRD GENERATION GOGGLE OBJECTIVE LENS Final Report
B. R. Chrisholm and R. M. Burley Jun. 1977 45 p refs
(Contract DAAK70-77-C-0044; DA Proj. 1E7-63719-DK-70)
(AD-A041546; BA6322-77-06) Avail: NTIS HC A03/MF A01 CSCL 17/8

Four objective lens designs for third generation (GEN 3) image intensifier tubes are analyzed. The lenses are coupled to the 0.255-inch thick photocathode faceplate of GEN 3 tubes and optical performance is studied in the response region from 0.7 microns to 0.9 microns. Other aspects of design considered in overall evaluation include projected manufacturing costs, as well as the size and weight of the lenses. Based on the data contained in this report, recommendations are presented for the further development of third generation night vision optical systems. Author (GRA)

N77-31956# Air Force Academy, Colo. Frank J. Seiler Research Lab.
ADAPTIVE ESTIMATION OF ABERRATION COEFFICIENTS IN ADAPTIVE OPTICS
Robert B. Asher May 1977 34 p refs
(AD-A041135; FJSRL-TR-77-0009) Avail: NTIS HC A03/MF A01 CSCL 20/6

There are significant optical wavefront perturbational effects in the use of lasers and in imaging through atmospheric turbulence. In adaptive optics, an active element such as a deformable mirror is used to eliminate the phase aberrations of an optical wavefront. Diagnostics to determine the phase distortions are obtained by various methods. The deformable mirror is used in a feedback loop in order to cancel the unwanted phase distortions. This paper considers what is known as a modal approach to the adaptive optics problem in which the wavefront distortions are expanded into a spatial set of polynomials. The coefficients of the polynomials are temporally varying and represent the time varying phenomenological perturbations such as atmospheric turbulence, thermal blooming, and mirror distortions. The measurement devices for the wavefront are either a shearing interferometer or a Hartman array. The shearing interferometer displaces or shears the wavefront and then interferes the sheared image with the unsheared image. The Hartman array yields a linear measurement of the aberration coefficients through an effective measurement of the gradient of the wavefront. Since the wavefront is temporally varying, state space models for the aberration coefficients are obtained. An adaptive estimator is developed in order to adapt upon the atmospheric turbulence structure constant and the bandwidth of the atmospheric turbulence, and to then obtain a minimum mean square estimator for the aberration coefficients. Author (GRA)

N77-31957# Air Force Weapons Lab., Kirtland AFB, N.Mex.
PRELIMINARY INVESTIGATION OF MECHANICAL RESPONSES OF FIBER OPTICS TO NUCLEAR RADIATION Final Report
J. C. Tucker, Kenneth J. Soda, and A. E. Mardiguian Jun. 1977 36 p refs
(AD-A041264; AFWL-TR-76-291) Avail: NTIS HC A03/MF A01 CSCL 20/6

Four generic types of optical fibers which have low optical responses to nuclear radiation were evaluated to detect any significant radiation-induced mechanical changes. Bend radius, flexure, mandrel strength, tensile strength and thermal cycling tests were performed. Fiber responses in tensile and bending qualities were observed, but while the changes should probably be considered in application engineering, they are not significant in disqualifying any fiber from use in radiation environments. Author (GRA)

N77-31958# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INVESTIGATION OF LUTETIUM DIPHTHALOCYANINE AS AN ELECTROCHROMIC DISPLAY MATERIAL Final Report, 1 Oct. 1976 - 31 Jan. 1977
M. M. Nicholson and R. V. Galiardi May 1977 68 p refs
(Contract N62269-76-C-0574)
(AD-A039596; C77-215/501; NADC-76283-30) Avail: NTIS HC A04/MF A01 CSCL 07/3

A new type of electrochromic display uses a rare-earth diphthalocyanine as the active material. Characteristics include switching energy of 1 mJ/sq cm, response time of 50 msec, nonvolatile memory, and good visibility in different directions under various lighting conditions. A full spectral range of colors is generated in lutetium diphthalocyanine by variation of the applied voltage. With further research and development, this system should be useful for full color imaging and graphic displays, as well as alphanumerics. Author (GRA)

N77-31959# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Physical Sciences Directorate.
THE EFFECTS OF SPECKLE ON RESOLUTION OF HIGH CONTRAST AND CONTINUOUS TONE OBJECTS
Charles R. Christensen and Adam Kozma 14 Dec. 1976 48 p refs
(AD-A040621; RR-77-2) Avail: NTIS HC A03/MF A01 CSCL 20/6

The effect of speckle in the imaging of diffusely illuminated gratings and continuous tone objects was studied. It was found that when imaging diffuse gratings the aperture of a coherently illuminated system must be 2.6 times as large as that of an incoherent system to obtain comparable resolution. This factor must be increased to five when imaging objects with a continuous spatial frequency distribution and range of contrast and to a factor of seven if the coherent image is subsequently low-pass filtered. A coherent system can achieve resolution which is comparable to an incoherent system of equal aperture if the coherent image is smoothed so that the mean to standard deviation ratio is ten or more. Author (GRA)

N77-31960# RAND Corp., Santa Monica, Calif.
A SOLUTION OF THE RAYLEIGH SCATTERING PROBLEM FOR PLANE-PARALLEL ATMOSPHERES OF LARGE OPTICAL THICKNESS
Anne Bettine Kahle Jan. 1977 152 p refs
(AD-A040881; P-5795) Avail: NTIS HC A08/MF A01 CSCL 04/1

The problem of radiative transfer in plane-parallel, perfectly scattering atmosphere is described. Chandrasekhar's solution applicable to atmospheres of small and moderate optical thickness is outlined. His solution reduces the problem to that of determining the X-, Y-, K-, and L-functions, the scattering functions. Mullikin has extended this method of solution to atmospheres of large optical thickness. Sekera and Kahle have used Mullikin's method of solution of calculating the emergent radiation from plane-parallel Rayleigh-scattering atmospheres of large optical thickness. Their numerical results are reproduced here in the Appendix, as tables of scattering functions. The numerical method for determining the intensity and polarization of the radiation emerging from the top and bottom of atmospheres is given, and suggestions for additional uses of the tables are made. Finally, a few examples of representative calculations are presented. Author (GRA)

N77-31961# Laser Diode Labs., Inc., Metuchen, N. J.
LIGHT EMITTING DIODES FOR FIBER OPTIC COM-

MUNICATIONS Quarterly Report, 30 Sep. - 31 Dec. 1976
Thomas E. Stockton 15 Apr. 1977 86 p
(Contract DAAB07-76-C-8135)
(AD-A040660; QR-1) Avail: NTIS HC A05/MF A01 CSCL 17/2

The design and fabrication of high speed etched-well light emitting diodes for fiber optic communications is discussed with regard to materials synthesis via LPE, wafer fabrication, and device assembly in a manufacturing environment. Author (GRA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-31962 Polish Academy of Sciences, Warsaw.
SPECTROSCOPIC MEASUREMENT OF THE TEMPERATURE OF ELECTRONS IN A SUPERSONIC STREAM OF IONIZED MERCURY VAPOR [SPEKTROSKOPOWY POMIAR TEMPERATURY ELEKTRONOW W NADDZWIEKOWYM STRUMIENIU ZJONIZOWANEJ PARY RTECI]
Z. Szymanski and M. Tarczynski 1 Dec. 1976 16 p refs In POLISH
Avail: Issuing Activity

The temperature of electrons in a supersonic stream of ionized gas was measured spectroscopically. A small supersonic tunnel operating on mercury vapor in which flow-through is generated in a constant manner in a two phase cycle of vaporization and condensation was utilized. The measurement of set states of excitation with main quantum numbers of 7 less than or equal to n less than or equal to 11 makes it possible to determine the temperature of electrons for an electron density greater than or equal to 5 x 10 to the 12th power cu cm. A diagram of the tunnel is presented. Author

N77-31963*# Old Dominion Univ. Research Foundation, Norfolk, Va.
FISSION INDUCED PLASMAS Progress Report, 15 Dec. 1976 - 30 Jun. 1977
Wynford L. Harries Sep. 1977 21 p refs
(Grant NsG-1362)
(NASA-CR-154894; PGSTR-PH77-62) Avail: NTIS HC A02/MF A01 CSCL 20I

The possibility of creating a plasma from fission fragments was investigated, as well as the probability of utilizing the energy of these particles to create population inversion leading to laser action. Eventually, it is hoped that the same medium could be used for both fissioning and lasing, thus avoiding inefficiences in converting one form of energy to the other. A central problem in understanding a fission induced plasma is to obtain an accurate model of the electron behavior; some calculations are presented to this end. The calculations are simple, providing a compendium of processes for reference. Author

N77-31964# Naval Research Lab., Washington, D. C. Plasma Physics Div.
SUPRATHERMAL ELECTRONS AND PEAK MAGNETIC FIELDS IN LASER-TARGET PLASMAS Interim Report
D. G. Colombant and D. A. Tidman (Maryland Univ., College Park) May 1977 11 p refs
(Contract E(40-1)-5000; NRL Proj. HO2-29A)
(AD-A040798; NRL-MR-3527) Avail: NTIS HC A02/MF A01 CSCL 20/9

The contribution of suprathermal electrons to the magnetic field generated in laser-target plasmas is discussed in terms of a two-fluid model including a single-temperature suprathermal electron fluid. In the neighborhood of the critical depth, one can approximate the effect of suprathermal electrons on the peak magnetic field by a simple multiplying factor on the source term due to the thermal electrons. Author (GRA)

N77-31965# Naval Surface Weapons Center, White Oak, Md.
THE DIFFERENTIAL SCATTERING CROSS SECTION FOR A PLASMA COLUMN IN RELATIVISTIC MOTION Final Report
Ronald L. Kligman 1 Jan. 1977 43 p refs
(SF32382101)
(AD-A040834; NSWC/WOL/TR-76-101) Avail: NTIS HC A03/MF A01 CSCL 20/9

Expressions are found for the differential scattering cross section of an infinitely long plasma column which has been irradiated by a plane electromagnetic wave. The propagation direction of the wave makes an arbitrary angle with the cylinder axis, and the plasma medium is allowed to move with an arbitrary velocity. Author (GRA)

N77-31966# Stanford Univ., Calif. Dept. of Mechanical Engineering.
PHYSICAL PHENOMENA IN FLOWING PLASMAS AT HIGH MAGNETIC FIELDS Interim Scientific Report, 15 Feb. 1976 - 14 Feb. 1977
R. H. Eustis, M. Mitchner, C. H. Kruger, and R. K. Hanson 14 Feb. 1977 17 p
(Contract F44620-76-C-0024; AF Proj. 2308)
(AD-A040142; AFOSR-77-0664TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

A four-pin electrical conductivity probe has been developed which is capable of providing a continuous record of space-resolved values of the electrical conductivity of MHD generator plasmas. Preliminary measurements have been made of the effect of flow velocity on the indicated electrical conductivity. GRA

N77-31967# California Univ., Livermore. Lawrence Livermore Lab.
LLL MIRROR FUSION PROGRAM: SUMMARY
T. K. Fowler 10 Feb. 1977 15 p
(Contract W-7405-eng-48)
(UCID-17387) Avail: NTIS HC A02/MF A01

A program is outlined for developing two new mirror concepts (field reversal and the tandem mirror) that can obtain high Q, defined as the ratio of fusion power output to the neutral-beam power injected to sustain the reaction. Theoretically, both concepts can attain Q = 5 or more, as compared to Q = 1 in previous mirror designs. Steps necessary to reach the long-range goal of an experimental mirror reactor operating by 1990 are discussed. ERA

N77-31968# California Univ., Livermore. Lawrence Livermore Lab.
UPDATE OF PLASMA PARAMETERS FOR A MIRROR FERF
R. S. Devoto 6 Jan. 1977 17 p
(Contract W-7405-eng-48)
(UCRL-52203) Avail: NTIS HC A02/MF A01

Current understanding of plasma behavior in mirror reactors was used to recalculate plasma parameters for a fusion engineering research facility (FERF) which uses a magnetic mirror. The most significant changes from results previously reported are a higher value of Q and a higher total neutron rate yielding a maximum neutron flux of 1.25 x 10 to the 14th minus sq cm at the wall. The required beam current is approximately 550 A, slightly greater than the 500 A previously estimated. ERA

N77-31969# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT AND CHARACTERIZATION OF MATERIALS FOR OPEN CYCLE MHD Quarterly Report, Apr. - Jun. 1976
J. Lambert Bates 1976 29 p refs
(Contract EY-76-C-06-1830)
(BNWL-2004-3) Avail: NTIS HC A03/MF A01

Activities performed in support of the U.S./U.S.S.R. magnetohydrodynamic power generation program are described. Progress is reported in characterizing and evaluating materials from the phase 1 U-O2 test, and developing and fabricating electrodes and insulator materials for the phase 2 test. Procedures were developed for fabricating three MgAl2O4 Fe3O4 electrodes with controlled microstructures. Methods for fabricating applying metal current leadouts to high temperature MHD electrodes were examined. ERA

N77-31970# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL SIMULATION OF LASER FUSION PLASMAS

USING A REDUCED DESCRIPTION FORMALISM Ph.D. Thesis
R. J. Faehl Dec. 1976 62 p refs
(Contract W-7405-eng-48)
(UCRL-52215) Avail: NTIS HC A04/MF A01

A computational study of laser fusion plasmas with a new numerical model is undertaken. The plasma is described by fluid equations and the fields by the time dependent Maxwell's equations. Problems of stimulated Brillouin scattering, self-steepening of the critical surface, wave trapping near the critical surface, and competition of inverse bremsstrahlung absorption with Brillouin scattering are treated to demonstrate the flexibility of the model. New results are obtained for intensity-dependent inverse bremsstrahlung absorption. Absorption of laser energy via density fluctuations in the underdense plasma is discussed and studied numerically for assumed fluctuation distributions. ERA

N77-31971# Oak Ridge National Lab., Tenn.
SURFACE AND IMPURITY STUDIES IN ORMAK AND ISX
R. J. Colchin, R. E. Clausing, L. C. Emerson, L. Heatherly, and R. C. Isler Feb. 1977 22 p refs Presented at Intern. Symp. on Plasma Wall Interaction, Julich, (F.R. Germany), 18 Oct. 1976
(Contract W-7405-eng-26)
(ORNL/TM-5671; Conf-761049-8) Avail: NTIS HC A02/MF A01

The ORMAK vacuum liner is constructed of stainless steel overcoated with a thin platinum diffusion barrier and a final layer of gold. Gold was selected because it is chemically inert to the adsorption of common gases. However, gold surfaces do absorb hydrocarbons, and carbon (along with oxygen) was the principal plasma contaminant during the first two years of ORMAK operation. Upon switching discharge-cleaning gases from hydrogen to oxygen, carbon levels dropped until carbon is no longer a significant contaminant; residual hydrocarbons can now be controlled either by hydrogen or by oxygen discharge cleaning. The principal measured plasma contaminant in ORMAK is now oxygen. Samples taken from the ORMAK liner and analyzed by Auger electron spectroscopy reveal the presence of iron and oxygen. There is evidence from a soft X-ray appearance potential spectroscopy probe of iron and chrominum diffusion from the stainless steel through the gold surface in spite of the platinum diffusion barrier. ERA

N77-31972# Oak Ridge National Lab., Tenn. Fusion Energy Div.
OAK RIDGE TOKAMAK EXPERIMENTAL POWER REACTOR STUDY. PART 5: ENGINEERING
T. E. Shannon, ed., R. L. Reid, ed., E. S. Bettis, M. B. Baer, C. F. Fisher, Jr., N. E. Johnson (Mechanics Research, Inc., Los Angeles), W. D. Jones, W. C. Stoddart, and H. L. Watts Feb. 1977 103 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5576) Avail: NTIS HC A06/MF A01

The results of the past year's effort in the engineering areas are documented. The discussion covers system identification and overall description, power conversion, plant layout, structural design, remote maintenance and assembly, program planning, and schedules. ERA

N77-31973# Princeton Univ., N. J. Plasma Physics Lab.
RAY TRACING IN AXISYMMETRIC TOROIDAL COORDINATES
S. L. Gralnick and H. E. Dalhed Feb. 1977 24 p refs Presented at 1st Topical Conf. on Numerical Methods (ANS), Tucson, Ariz., 28 Mar. 1977
(Contract EY-76-C-02-3073)
(PPPL-1324; Conf-770304-9) Avail: NTIS HC A02/MF A01

A method is presented for determining the trajectory of a particle moving along a straight line orbit in axisymmetric toroidal coordinate systems. These geometries occur in problems associated with neutral, neutron, and radiation transport studies in Tokamak fusion devices. Numerical solutions of the equations describing the trajectory are performed in geometric configurations generated by the solution of the plasma equilibrium problem. An example problem of the deposition of a pencil beam of high energy neutral particles in a Tokamak of incorporating a divertor and the desirability of operating at a high plasma energy density is described. ERA

N77-31974# Oak Ridge National Lab., Tenn.
CALCULATION OF A SELF-CONSISTENT, LOW FREQUENCY ELECTROSTATIC FIELD IN TOROIDAL GEOMETRY
C. O. Beasley, H. K. Meier, W. I. VanRiji, and J. E. McCune (MIT, Cambridge) Mar. 1977 26 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5784) Avail: NTIS HC A03/MF A01

An asymptotic series in the inverse-square plasma frequency, for the self-consistent, curl-free, low frequency electric field in tori is derived. The derivation is consistent with the drift-kinetic ordering and may be used in either instability or equilibrium calculations. An interpretation of past formulations of the statement of quasi-neutrality as applied to neoclassical equilibria is also provided. ERA

N77-31975# Oak Ridge National Lab., Tenn. Fusion Energy Div.
COMPARISON OF MODEL DISTRIBUTION FUNCTIONS WITH COLLISIONAL PLASMA MODEL (CPM) RESULTS IN VARIOUS COLLISIONALITY REGIMES
T. Uckan (Michigan Univ., Ann Arbor) Feb. 1977 34 p refs
(Contract W-7405-eng-48)
(ORNL/TM-5761) Avail: NTIS HC A03/MF A01

Neoclassical equilibrium and transport have been calculated with analytic solutions of a drift-kinetic equation in which the effect of collisions is included. The necessary introduction of approximations precluded the full description of the distribution function in all regimes and over all particle energies. Techniques inherent to the collisional plasma model (CPM) were used to develop a computer simulation for the dynamics of toroidally confined plasmas in the drift-kinetic, Fokker-Planch description. The CPM permits study of the neoclassical equilibrium without approximation in the drift-kinetic ordering. The neoclassical electron distribution function derived by Rosenbluth et al is compared with the CPM for the banana regime and good general agreement is obtained. The CPM is also compared with calculations in the Pfirsch-Schlueter regime. When approximations made in these calculations are taken into consideration, good agreement is observed. ERA

N77-31976# Pennsylvania State Univ., University Park.
SCALING OF END LOSS TIMES IN LINEAR THETA PINCHES
Thomas M. York Jan. 1977 21 p refs
(Contract EY-76-S-02-4020)
(COO-4020-1; SR-77-1) Avail: NTIS HC A03/MF A01

The influence of energy loss on the particle loss from the ends of a linear theta pinch is examined. The basic formalism for the equations which have been used to scale linear theta pinches is first developed, then examined relative to inherent constraints. Characteristic times for pinch, compression, wave propagation, and loss for various experiments are noted to be not repetitively ordered, thus making data extrapolation difficult. Taking ion temperature as a decaying variable, the e-folding particle loss time (t/sub e/) is evaluated in a self-consistent fashion, first for exponential T/sub i/ decay (t/sub thl/) and also for linear T/sub i/ decay. Expressions for particle loss times are evaluated for t/sub thl/ less and greater than, respectively, t/sub e/. Expressions for scaling loss time are presented. Millisecond particle loss times for moderate length (approximately 150 meters) linear pinches are indicated because of low temperatures at the ends due to energy loss. ERA

N77-31977# Fairchild Republic Co., Farmingdale, N.Y.
PLASMA ACCELERATION IN PULSED ABLATIVE ARC DISCHARGES Final Report, 15 Mar. 1974 - 31 Mar. 1977
Dominic J. Palumbo and Martin Begun 1977 76 p refs
(Contract F44620-74-C-0055)
(AD-A039219; AFOSR-77-0623TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

This program was an effort to describe and understand plasma acceleration processes in pulsed ablative plasma accelerators using a continuum MHD approach as the basis for analytic modeling. Concurrent with analytic modeling, an experimental diagnostic

effort was performed so that calculated results could be compared to the measured parameters for verfication of the model. Diagnostic measurements included magnetic flux density using small coil probes, current distribution using a Rogowski coil plasma front location and velocity using time of arrival probes, high speed photography using a high speed framing camera, and electron number density and temperature using Langmuir probes. Data was recorded on a digital memory oscilloscope. An unsteady two-dimensional model of the plasma motion was postulated. The model included direct coupling of the external capacitor discharge circuit to the plasma via the time variant plasma resistance and inductance. Ablated (depolymerized) solid propellant appears to be dissociated and ionized very quickly with respect to the duration of the discharge. Author (GRA)

N77-31978# Indiana Univ., Bloomington. Dept. of Chemistry.
A MODIFIED MICROWAVE-INDUCED PLASMA (MIP) DISCHARGE CHAMBER EXHIBITING HIGH STABILITY AND IMMUNITY FROM SAMPLE SOLVENT EXTINGUISHMENT
Andrew T. Zander, Rod K. Williams, and Gary M. Hieftje Jun. 1977 16 p refs
(Contract N00014-76-C-0838)
(AD-A040820; TR-5) Avail: NTIS HC A02/MF A01 CSCL 20/8

A simple modification has been made to the discharge chamber of a microwave-induced plasma (MIP) at atmospheric pressure. The positioning of two carbon washers in approximately one-third of the region within which the MIP exists allows the formation of an auxiliary plasma which is unaffected by material entering the MIP. The auxiliary plasma provides thermal stabilization of the cavity when the primary MIP is adversely affected while solvent vapors pass through the chamber, reignites the MIP automatically, and increases MIP stability by keeping it centered in the chamber. The carbon washers do not significantly alter the spectral character of the MIP. Author (GRA)

N77-31979# Naval Research Lab., Washington, D. C.
SPECTROSCOPIC OBSERVATION OF FAST IONS FROM LASER - PRODUCED PLASMAS Interim Report
E. A. McLean, R. Decoste, B. H. Ripin, and J. A. Stamper May 1977 11 p refs
(AD-A040983; NRL-MR-3526) Avail: NTIS HC A02/MF A01 CSCL 07/4

Using a time-of-flight spectroscopic technique, measurements were made of the ion energy distributions of very fast ions and thermal ions produced when a 7-15 J, 100 psec Nd:glass laser pulse (1.06 micrometer) strikes a $(CH2)n$ slab target. Ion energies greater than 0.5 MeV have been observed for the first time with this technique of measurement. A simultaneous comparison is made between the signal of an ion charge collector placed 30 cm from the target and the intensity of the C VI 3434 A ion line at 1 cm from the target. Author (GRA)

N77-31980# Atomic Energy Organization of Iran, Teheran. Laser Technology Section.
PRELIMINARY DESIGN OF EXPERIMENT HIGH POWER
R. K. Mosavi, Y. Kohanzadeh, M. Taherzadeh, and A. Vaziri Mar. 1976 14 p refs
(AEOI-18) Avail: NTIS (US Sales Only) HC A02/MF A01

This experiment is designed to produce plasma by carbon dioxide pulsed laser, to measure plasma parameters and to study the interaction of the produced plasma with intense laser beams. The objectives of this experiment are the following: (1) to set up a TEA CO2 laser oscillator and a cold cathode electron beam laser amplifier together as a system, to produce high energy optical pulses of short duration; (2) to achieve laser intensities of 10 to the 11th power watt/sq cm or more at solid targets of polyethylene $(C2H4)n$, lithium hydride (LiH), and lithium deuteride in order to produce high temperature plasmas; (3) to design and develop diagnostic methods for studies of laser-induced plasmas; and (4) to develop a high power CO2 laser amplifier for the purpose of upgrading the optical energy delivered to the targets. ERA

N77-31981# Association Euratom-CEA, Fontenay-aux-Roses (France). Groupe de Recherches sur la Fusion Controlee.
REVIEW OF THE STATE OF THE ART WITH TOKAMAKS IN USSR
S. V. Mirnov, V. S. Mukhovatov, V. S. Strelkov, and V. D. Shafranov Jul. 1976 35 p refs Transl. into FRENCH from Fiz. Plazmy (USSR), v. 2, 1976 p 348-360 In FRENCH
(EUR-CEA-FC-839-TR) Avail: NTIS (US Sales Only) HC A03/MF A01)

The U.S.S.R. Tokamak programm is realized with some fifteen different devices that may be distributed in five groups according to the aim of the research: the T-4, T-10, T-20 Tokamak line is intended for enhancing the plasma parameters due to the increase in the dimensions of the apparatus. The small sized, noncircular section T-8, and T-9 Tokamaks are intended for the search of new configurations; the decrease in the impurity influx is studied on T-12, TO-2, TM-4, TB-0, and the supplementary heating and stabilization are studied on TM-3, Tuman-2, T-11, TF-1, TM-1-HF, TO-1, and Tuman-3. New principles of creating magnetic systems are investigated on T-7. Among these devices, seven are now operating: T-4, TM-3, T-9, Tuman-2, TO-1, TF-1, and TM-1-HF. Experiments on T-10, T-8, and T-11 are about to start; T-12, TO-2, TM-4, T-7, and Tuman-3 are in course of construction, and TB-0 and T-20 are still in contemplation. ERA

N77-31982# Association Euratom-CEA, Fontenay-aux-Roses (France). Group de Recherchessur la Fusion Controlee.
TORUS 2. PART 2: TECHNICAL DESCRIPTION OF THE DESIGN PROPOSAL
R. Aymar, C. Deck, P. Deschamps, D. Lafon, C. Leloup, M. Pariente, C. Renaud, Z. Sledziewski, and A. Torossian Jun. 1976 196 p refs
(EUR-CEA-FC-824-Pt-2) Avail: NTIS (US Sales Only) HC A09/MF A01

A new Tokamak device, called TORUS 2, is proposed to be built. This is a large machine: I=1.7MA; B=30kGs; R=1.8m; a=75cm, designed to follow the lines of research already initiated on plasma heating, on impurities and on energy confinement and scaling laws. This part of the report provides a technical description of the main components of the basic machine. Every subsystem whose assembly forms the basic machine is the subject of one section: vacuum vessel, toroidal field coils, poloidal field system, mechanical structures, monitoring, control and data acquisition, and power supplies. Contributions are given which show the state of development of the peripheral systems envisaged for TORUS mainly, additional heating, control of impurities, and plasma diagnostics. ERA

N77-31983# Association Euratom-CEA, Fontenay-aux-Roses (France). Groupe de Recherecheshes sur la Fusion Controlee.
ASYMPTOTIC BEHAVIOUR OF GORDEYEV'S INTEGRAL
R. B. Paris Oct. 1976 22 p refs
(EUR-CEA-FC-829) Avail: NTIS (US Sales Only) HC A03/MF A01

The Gordeyev integral appears in the expression of the dielectric function in the dispersion relation, in the study of the propagation of electrostatic waves in a hot magnetized plasma. The asymptotic behavior of this integral is studied. ERA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N77-31984 State Univ. of New York, Stony Brook.
INTERACTIONS BETWEEN COUPLED THIN-FILM MICROBRIDGE JOSEPHSON JUNCTIONS Ph.D. Thesis
Don Warren Jillie, Jr. 1976 143 p
Avail: Univ. Microfilms Order No. 77-10746

The interactions between two coupled indium microbridge Josephson junctions separated by as little as 1.5um of superconducting film and fabricated using electron beam lithography are manifested by large distortions in the voltages and critical currents of the bridges. Both the general interaction and the voltage-locking interaction were investigated. Measurements made on series arrays of microbridges are reported. The status of weak-link theory is reviewed, and experimental results for single microbridges are presented. These include results on general properties, the variation

of critical current with temperature, the AC Josephson effect, and heating effects. Dissert. Abstr.

N77-31985 Pennsylvania State Univ., University Park.
CRYSTALLOGRAPHIC CONTROLS ON THE LUMINESCENCE OF INSULATOR PHOSPHORS Ph.D. Thesis
Rick L. Mohler 1976 127 p
Avail: Univ. Microfilms Order No. 77-10666

The luminescence processes were studied in titanium and praesodymium activated compounds and in carbon and manganese activated spinels. The transition metal activators were sensitive to the local crystal field of the host, and thus to the structural order of the host material. Investigation of titanium activated phosphors, permitted the proposal of a model to interpret the observed luminescence. The temperature quencing of praesodymium luminescence differed from that observed from other rare earth metals; however, a model was developed as a possible explanation of the behavior. Dissert. Abstr.

N77-31986 Indiana Univ., Bloomington.
FLUCTUATION SUPERCONDUCTIVITY IN BULK TITANIUM-FIELDS ALLOYS IN HIGH MAGNETIC FIELDS Ph.D. Thesis
Albert Gallatin Montgomery 1976 109 p
Avail: Univ. Microfilms Order No. 77-10945

Four-Point isothermal (1.2-4.2K) measurements of dc resistivity p(H,T) of four superconductive binary bcc alloys of Ti (with Mo, Ru, Os, and Fe solute components) were made in high homogeneity high magnetic fields. A magnetic field up to 140 kG was applied either parallel or perpendicular to the constant measuring current density. Typical isothermal measurement below the zero magnetic field transition temperature upon increasing the magnetic field sequentially revealed: (1) passage into the static-equilibrium resistive state, (2) associated transition rounding which we attribute to thermodynamic fluctuations of the superconducting order-parameter, (3) a resistance maximum, and (4) a slight negative transition temperature that is apparently independent of magnetic field at sufficiently high magnetic field strength. Dissert. Abstr.

N77-31987 Maryland Univ., College Park.
THE STUDY OF PROTON DYNAMICS IN SOME HYDROGEN BONDED CRYSTALS Ph.D Thesis
Mei-Hwa Sun 1976 110 p
Avail: Univ. Microfilms Order No. 77-10428

Infrared and Raman spectra of KHSO4, RbHSO4, KH2 PO4, NaH3-(SeO3)2 crystal were recorded at room temperature, liquid nitrogen temperature, and in some instances above room temperature, and investigated especially in the hydrogen stretching region where the observed features of the spectra can not be explained in terms of either a symmetric or an asymmetric double minimum well due to intrabond tunneling alone. The frequencies of the observed bands in the fundamental and the overtone region of the OH stretching mode can be qualitatively explained on the basis of the energy levels of a proton in a multiminimum well due to interbond tunneling. The temperature independent nature of the bands can also be explained if interbond tunneling is taken into consideration. Dissert. Abstr.

N77-31988# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
A PERTURBATION ANALYSIS OF THE ATTENUATION AND DISPERSION OF SURFACE WAVES
H. F. Tiersten and B. K. Sinha Apr. 1977 35 p refs
(Contract N00014-76-C-0368)
(AD-A040100; TR-21) Avail: NTIS HC A03/MF A01 CSCL 20/14

A perturbation formulation of the equations of linear piezoelectricity is obtained using a Green's function approach. The extended equation is applied in the calculation of the attenuation of surface waves due to the finite electrical conductivity of thin metal films plated on the surface and air loading. Since the metal films are thin compared with a wavelength, and approximate thin plate conductivity equation is employed in the determination of the attenuation due to the electrical conductivity of the films, the resulting attenuation is obtained over a very large range of values of sheet conductivity. This is accomplished by using the equation for the first perturbation of the eigenvalue iteratively to determine the solution and attendant attenuation to any desired degree of accuracy. The phase velocity dispersion curve due to the mechanical effect of a thin film plated on a substrate is determined for relatively large wavelengths by employing the perturbation equation iteratively, and excellent agreement is obtained with the results of other more direct approaches. GRA

N77-31989# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
GERMANIUM FILM PROGRAM
Herbert Kivlighn, Jr. Jul. 1976 39 p refs
(AD-A040582; RM-624) Avail: NTIS HC A03/MF A01 CSCL 20/8

This report discusses the efforts that were expended toward assessing the formation of elemental germanium films from oxygen-deficient germanate glasses. An attempt has been made to physically characterize them from the viewpoint of amorphous/crystalline content, at least in the qualitative sense. A possible mechanism of film formation is also presented. The latter section deals with preliminary photoexcitation experiments which yielded positive reproducible photovoltage responses in some of the films. Author (GRA)

N77-31990# Northeastern Univ., Boston, Mass.
INVESTIGATION AND DESIGN OF ELECTRONIC CIRCUITRY RELATED TO NOISE AND RADIATION EFFECTS FOR SOLID STATE DEVICES AND CIRCUITS Final Report, 1 Nov. 1973 - 31 Oct. 1976
Basil L. Cochrun Griffiss AFB, N. Y. RADC Mar. 1977 63 p
(Contract F19628-74-C-0051)
(AD-A040936; RADC-TR-77-105) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report details the design and operation of four different instrumentation systems. These are circuitry for evaluating the charge and discharge characteristics of Schottky diode detectors, an optical signal and random noise source, noise reduction circuitry and an IR detector three phase CCD scanning system.
Author (GRA)

N77-31991# Rockwell International Science Center, Thousand Oaks, Calif.
STUDY OF THE DEPENDENCE OF PHOTOENHANCED NONLINEAR ACOUSTIC SURFACE WAVE INTERACTIONS ON THE WAVELENGTH OF LIGHT Final Report, 15 Mar. 1975 - 14 Mar. 1977
Edgar E. Kraut and Teong C. Lim 10 May 1977 25 p refs
(Contract DAAG29-75-C-0015)
(AD-A041045; SC5027.4FR; ARO-11928.2-P) Avail: NTIS HC A02/MF A01 CSCL 20/12

The effect of illumination with bandgap light on the convolution of surface acoustic waves on ZnO and GaAs has been investigated as a function of light wavelength and crystal temperature. The experiments indicate that the photoenhancement effect in ZnO is sensitive to trapping and surface preparation. A possible model for the dependence of photoenhancement on photon wavelength in ZnO has been proposed. Attempts to observe the photoenhancement effect in GaAs were unsuccessful because of problems in obtaining the correct sample resistivity.
Author (GRA)

N77-31992# McDonnell-Douglas Research Labs., St. Louis, Mo.
DEVELOPMENT OF THE HgCdSe ALLOY SYSTEM FOR INFRARED SENSOR APPLICATIONS Final Report, 15 Jul. 1974 - 15 Feb. 1976
C. R. Whitsett, C. J. Summers, J. G. Broerman, D. A. Nelson, and B. B. Rath Wright-Patterson AFB, Ohio AFAL Feb. 1977 148 p refs
(Contract F33615-74-C-5167)
(AD-A041534; AFAL-TR-76-112) Avail: NTIS HC A07/MF A01 CSCL 17/5

The objective of this program was to establish the feasibility of developing selected compositions from the mecury-cadmium-selenide alloy system for infrared sensor applications. The Air Force has requirements in three wavelength regions of the infrared spectrum: 2.5-2.8 micrometers, 4.2-4.5 micrometers, and 8-14 micrometers. The emphasis in this program was on

compositions of mercury-cadmium-selenide suitable for these wavelength regions. Principal questions that were to be answered by this research program are: What alloy compositions correspond to the wavelengths of interest. Are these compositions readily grown with reasonably large single-crystal regions where the ratio of mercury to cadmium is uniform. Can stoichiometry be adjusted to provide low carrier concentration, high carrier mobility, and long carrier lifetime. Are there special features such as traps for minority carriers, a large ratio of electron-mobility to hole-mobility, or good stability in vacuum at elevated temperatures to permit high-temperature bake-out. GRA

N77-31993# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1977:1 Quarterly Technical Summary Report, 1 Nov. 1976 - 31 Jan. 1977
Alan L. McWhorter 29 Apr. 1977 54 p refs
(Contract F19628-76-C-0002; AF Proj. 649L)
(AD-A041226; ESD-TR-77-44) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 November 1976 through 31 January 1977. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and ERDA. GRA

N77-31994# Naval Postgraduate School, Monterey, Calif.
COMPUTER SIMULATION OF THE SPUTTERING OF SILICON M.S. Thesis
Gary Lloyd Smith Jun. 1977 177 p refs
(AD-A041152) Avail: NTIS HC A09/MF A01 CSCL 13/8

Simulation models were developed for the bombardment of the (100), (110), and (111) orientations of a single-crystal silicon lattice by an argon ion. The interatomic potentials included repulsive terms only, and were approximated in closed analytic form by least-squares fitting of the calculated interatomic potentials obtained from the Hartree-Fock-Slater self-consistent field equations. Sputtering was found to be predominantly a surface effect with most sputtering events occurring in the first three crystal layers. The (110) orientation demonstrated a sputtering mechanism not previously observed in fcc copper simulations, and the (111) orientation showed that reflection of the knock-on atom from lower crystal layers is more common in silicon than in the fcc copper lattice. Adjustment of the surface binding energy parameter to a value of 4-7 eV produced results which agree with available experimental data. Author (GRA)

N77-31995# Aerospace Corp., El Segundo, Calif. Materials Science Lab.
CARBON: OCCURRENCE OF LINEAR FORMS IN NATURAL GRAPHITE Interim Report
A. Greenville Whittaker 15 Apr. 1977 13 p refs
(Contract F04701-76-C-0077)
(AD-A039520; TR-0077(2250-10)-2; SAMSO-TR-77-94) Avail: NTIS HC A02/MF A01 CSCL 20/2

A study of several natural carbon formations, from geographical locations ranging from Celyon to California, revealed that the carbons contain small amounts of linear carbon forms, e.g., chaoite, alpha carbyne, and bete carbyne. The results indicate that these 'rare' carbon forms have worldwide distribution and, as with diamond, are prevented from transformation to graphite by a high kinetic barrier. Author (GRA)

N77-31996# Colorado State Univ., Fort Collins. Dept. of Physics.
MULTI-LAYER MODEL OF InAs EPILAYERS
H. A. Washburn 15 Apr. 1977 16 p refs
(Contract N00014-76-C-0976)
(AD-A040028; SF11) Avail: NTIS HC A02/MF A01 CSCL 20/12

The charge carrier transport coefficients of an inhomogeneous, thin semiconductor in an indium arsenide MOS structure were obtained using a multilayer model. The expression for the Hall coefficient of a three-layer system extended to arbitrary strength magnetic fields was used to separate the bulk transport parameters from the parameters describing transport at the two surfaces. Experimentally, a gate voltage was used to vary the surface under the oxide from depletion to accumulation and the Hall coefficient measured as a function of magnetic field. Author (GRA)

N77-31997# Stanford Univ., Calif. Center for Materials Research.
CONTROL OF IMPURITIES IN THE EPITAXIAL GROWTH OF HIGH QUALITY GaAs. RESPONSE OF THE MOLECULAR BEAM-MASS SPECTROMETER ANALYSIS AND CALIBRATION
David A. Stevenson May 1977 44 p
(Contract N00014-75-C-0887).
(AD-A040692; SU-CMR-77-14) Avail: NTIS HC A03/MF A01 CSCL 20/2

A molecular beam-mass spectrometer (MBMS) has been developed to sample ambient gas atmosphere in epitaxial growth systems at high temperatures and at atmospheric pressure. At present the MBMS is capable of analyzing ppm quantities of gaseous species that result from chemical transport reactions between the ambient H2 atmosphere and the growth system components (e.g., fused quartz and graphite). The MBMS consists of three differentially pumped stages separated by a nozzle and a skimmer orifice and a detector aperture. The gas is expanded through the nozzle to establish a supersonic flow region (Mach disc) which is sampled by the skimmer to develop a well-collimated molecular beam. The molecular beam is then ionized and detected by a quadrapole mass analyser. The response and interpretation of the data from the MBMS are analyzed and discussed to obtain an overall calibration of the system. The sensitivity for most gaseous species in H2 at atmospheric pressure and at 800 C is better than 1 ppm without chopping the beam. Initial results indicate that there are ppm levels of Ar, CO and H2O in palladium purified H2. In addition, the formation of SiO and H2O by chemical transport reactions between H2 and fused quartz at 700 C and above are in good agreement with existing high temperature thermodynamic data. Author (GRA)

N77-31998# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
PROPERTIES OF SILICON IMPLANTED WITH ARSENIC THROUGH SILICON DIOXIDE Ph.D. Thesis
David Richard Myers Jan. 1977 150 p refs
(Contract DAAB07-72-C-0259; Grant NSF-AMR-73-02359)
(AD-A040683; R-756; UILU-ENG-77-2203) Avail: NTIS HC A07/MF A01 CSCL 20/2

The properties of silicon after annealing of arsenic implantations through silicon dioxide are studied, and compared with those resulting from arsenic implantations into bare silicon surfaces. Photoluminescence studies of radiation damaged silicon establish the 0.970 eV peak as arising from a carbon-dependent center. The same studies also confirm that the 0.790 eV luminescence arises from an oxygen dependent center, and suggest that this center may depend on carbon as well. With the oxygen dependence of the center responsible for the 0.790 eV luminescence established, it is possible to monitor the presence of excess oxygen in silicon by the presence of this peak in the recombination spectra of silicon after irradiation. Thus, observation of 0.790 eV luminescence from float zone grown silicon samples implanted with arsenic through silicon dioxide, and not from identical samples in which the silicon dioxide was chemically removed prior to arsenic implantation, is interpreted as direct evidence for the recoil implantation of oxygen into the silicon from the silicon dioxide layer. The effect of recoil-implanted oxygen on the transport properties of silicon implanted with arsenic to fluences of 10 to the 15th power/sq cm and 50 to the 15th power/ sq cm is then examined. Sheet resistivity and sheet Hall coefficient measurements following various annealing stages indicate identical recovery for through-oxide implants and for bare surface implants. GRA

N77-31999# Westinghouse Research Labs., Pittsburgh, Pa.
THIN FILM MEMORY DEVICES Final Report, 1 Jun. 1975 - 13 Dec. 1976
K. K. Yu, P. R. Malmberg, and T. P. Brody 15 Apr. 1977 90 p refs
(Contract N00014-75-C-1138)
(AD-A040576; Rept-77-9G9-MEMRY-R1; ONR-CR-213-134-1F) Avail: NTIS HC A05/MF A01 CSCL 09/2

Individual memory transistors have been developed which are ten times faster than previous transistors. Various charging mechanisms of the memory transistor were considered. It now appears that the high channel impedance model most accurately represents the slow negative WRITE behavior of the memory transistors. Addressing and control circuits were designed to permit practical operation of the memory in a block access mode. A WRITE mode was developed which greatly reduced the disturbance of non-addressed memory cells. A high density memory test array was designed and fabricated with operating memory cells. Sufficient knowledge and experience were gained through this work to permit us to make a practical nonvolatile thin film memory compatible with existing computer systems.
Author (GRA)

N77-32000# Newcastle-upon-Tyne Univ. (England). Dept. of Electrical and Electronic Engineering.
NEW PASSIVATION METHODS GaAs Final Technical Report, Jan. - Dec. 1976
B. Bayraktaroglu, A. Colquhoun, A. F. A. B. El-Safti, S. J. Hannah, and H. L. Hartnagel Jan. 1977 68 p refs
(Grant DA-ERO-76-G-019)
(AD-A040042) Avail: NTIS HC A04/MF A01 CSCL 20/12

The investigation of the anodic growth processes of semiconductor oxides has resulted in improved oxides, superior interface conditions between semiconductor and oxide, and long-term charge storage devices. MOSFETs in the three modes of inversion, depletion and accumulation were fabricated and useful electronic characteristics were obtained. The study of an optimization of the electrolyte and other aspects were continued. Further results on the oxidation of InP are presented.
Author (GRA)

N77-32001# California Univ., Los Angeles. Dept. of Chemistry.
CROSS RELAXATION BETWEEN THE SPIN LEVELS OF PHOSPHORESCENT 1,2,3,4,5-TETRACHLORBENZENE AND PHOTOCHEMICAL PRODUCTS OF THE DURENE HOST
William M. Pitts and M. A. El-Sayed Jun. 1977 29 p refs
(Contract N00014-75-C-0602)
(AD-A041008; TR-26; Contrib-3819) Avail: NTIS HC A03/MF A01 CSCL 07/4

At certain magnetic fields, intensity changes have been observed in the phosphorescence of 1,2,4,5-tetrachlorobenzene (TCB) doped in a single crystal of durene cooled to 1.6 K. These changes are found to result from cross relaxation (CR) processes between the spin levels of the lowest triplet state of TCB and the spin levels of a photochemically produced spin system. Experiments show that the presence of duraldehyde within the host crystal of durene is important for the production of the observed photoproducts. Following the application of a magnetic field of the proper magnitude and direction to induce CR, the phosphorescence intensity of TCB displays an observable time behavior. There is a sharp rise in phosphorescence intensity, followed by a fast decrease and finally a slow exponential decay to a new steady state, which is higher in intensity than that observed in the absence of CR. Rate equations describing the time behavior of the populations of the various spin levels are derived and solved numerically. From the calculated triplet state populations as a function of time, it is possible to calculate the time behavior of the phosphorescence intensity. Results of experiments and calculations suggest that the photoproduct responsible for the CR is doublet spin system with a spin lattice relaxation time of approximately 18 seconds at 1.6K.
Author (GRA)

N77-32002# Stanford Univ., Calif.
SUPERCONDUCTIVE TUNNELING INTO NIOBIUM-TIN THIN FILMS
D. D. Moore 2 Apr. 1976 5 p refs
(Contract AF-AFOSR-2435-73)
(AD-A041473; AFOSR-77-0421TR) Avail: NTIS HC A02/MF A01 CSCL 20/10

Oxide layer tunnel junctions exhibiting both quasi-particle and Josephson tunneling were produced by overlaying lead on electron beam evaporated niobium-tin thin films. The surface properties of these niobium-tin films are quite reproducible, vary in regular manner, and appear to reflect the bulk superconductivity of the films. The superconducting transition temperature and average energy gap of the niobium-tin both increased as the tin concentration increased.
GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-32003# Georgia Inst. of Tech., Atlanta.
ELECTRICAL AND THERMAL CONDUCTIVITY AND RADIATION POWER OF AIR MEASURED AT 1-30 ATM AND 6500-11500 DEG K Final Report, Jun. 1974 - Sep. 1975
A. V. Larson and J. R. Williams Jun. 1977 54 p refs
(Contracts F40600-76-C-0004; F40600-74-C-0007)
(AD-A040565; AEDC-TR-77-69) Avail: NTIS HC A04/MF A01 CSCL 20/9

Experimental results are reported on the electrical and thermal conductivities and the radiative properties of air plasma at pressures of 1, 6 and 30 atm. in the temperature range 6,500 K to 11,500 K. A wall-stabilized steady cascade arc was used to provide a cylindrically symmetric column of air plasma. The electrodes were bathed in argon. The electrically floating wall plates were used to determine the electric field strength in the column. Side-on optical measurements of the lateral intensity profile using the oxygen 844.6 nm line and the nearby continuum permitted the deduction of the radial temperature profile using the Abel Inversion. Total radiation per unit arc length for wavelengths transmitted through a quartz window was measured by a thermopile. Temperature dependent trial functions of electrical conductivity and radiation strength per unit volume were optimized by computer to fit the experimental data. Thermal conductivity was then obtained from the energy balance. The experimental results agree well with the existing experiments and theories at 1 atm. At the higher pressures, the experiments are original and compare favorably to theory.
Author (GRA)

N77-32004# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON NONLOCAL CONTINUUM MECHANICS
A. E. Green and P. M. Maghdi May 1977 27 p refs
(Contract N00014-75-C-0148)
(AD-A040765; UCB/AM-77-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

It is shown in this paper that the conservation laws of nonlocal continuum mechanics are equivalent to, and can be derived from, the conservation of energy and the invariance conditions under superposed rigid body motions. Also, the theory of nonlocal thermoelasticity is reconsidered in the light of recent developments in thermodynamics, taking invariance conditions fully into account.
Author (GRA)

N77-32005# California Univ., Berkeley. Dept. of Mechanical Engineering.
THE SECOND LAW OF THERMODYNAMICS AND CYCLIC PROCESSES
A. E. Green and P. M. Naghdi May 1977 14 p refs
(Contract N00014-75-C-0148)
(AD-A040869; UCB/AM-77-2) Avail: NTIS HC A02/MF A01 CSCL 20/3

This paper is concerned with the implications of an inequality proposed recently by Green and Naghdi in regard to the classical statement of the second law of thermodynamics associated with cyclic thermo-mechanical processes. The results obtained are compared with corresponding previous developments by Fosdick and Serrin and by Truesdell who employ the Clausius-Duhem inequality.
GRA

N77-32006# Argonne National Lab., Ill.
TURNING POINT IN THE DEVELOPMENT OF QUANTUM MECHANICS AND THE EARLY YEARS OF THE MOESSBAUER EFFECT
Harry J. Lipkin Aug. 1976 18 p Presented at 1976 Inter. School of Subnuclear Phys., Geneva, Jul. - Aug. 1976
(Contract W-31-109-eng-38)
(CONF-760737-1) Avail: NTIS HC A02/MF A01

The importance of giving graduate students a broad view of quantum mechanics principles and applications is argued. The acceptance of quantum mechanics as an adequate theory to explain small-distance phenomena is described, and an example is given applying quantum mechanics to the theory of identical particles. The discovery of the Mossbauer effect and the course of its eventual acceptance by the physics community is then reviewed. J.H.

N77-32007# Kansas Univ., Lawrence. Dept. of Chemistry.
HIGH TEMPERATURE THERMODYNAMICS AND VAPORIZATION OF STOICHIOMETRIC TITANIUM MONOXIDE Ph.D. Thesis
Robert I. Sheldon and Paul W. Giles 17 Aug. 1976 209 p refs
(Contract E(11-71)-1140)
(COO-1140-219) Avail: NTIS HC A10/MF A01

Two constant temperature experiments designed to measure the equilibrium vapor pressures of Ti(g) and TiO(g) are described. In one, the total amount of titanium deposited on a water cooled quartz cap surrouding a tungsten Knudsen effusion cell from titanium monoxide was vaporized was measured colorimetrically. In the second experiment, the vapor composition in equilibrium with nearly stoichiometric titanium monoxide was measured mass spectrometrically. The temperature dependence of the ions Ti+(48) and TiO(64) were also measured spectrometrically. Results are compared with published thermodynamic properties of the titanium oxygen system. ERA

N77-32008# Teague (Ben), Austin, Tex.
THERMAL CONDUCTIVITY OF CRUSHED SALT
K. Kuehn Mar. 1977 16 p refs Transl. into ENGLISH of "Ueber die Waermeleitfaehigkeit von Salzgrus", Ges. fuer Strahlenforsch. m.b.H., Munich, 15 Sep. 1969 Sponsored by ERDA Prepared for Sandia Labs., Albuquerque, N. Mex.
(SAND-77-6003) Avail: NTIS HC A02/MF A01

Heat transfer through an annular space filled with crushed salt depends primarily on the thermal conductivity, lambda, of the material. This report gives a formula with which lambda can be computed. The formula includes two quantities that can be influenced by salt grain sizes: the porosity, psi, and the fraction, alpha, of the more highly resistive heat-flow paths. The report computes and presents graphically the thermal conductivities for various values of psi and alpha. Heat-transfer properties are computed and compared for an annular space filled with crushed salt and for an air gap. The comparison shows that the properties of the annular space are larger only up to a certain temperature, because the properties of the air gap increase exponentially while those of the annular space increase only in an approximately linear way. Experimental results are in good agreement with the calculation performed. ERA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-32009# DGS Associates, Inc., Washington, D. C.
THE REPORTING OF FEDERAL RESEARCH AND DEVELOPMENT RESOURCES APPLIED TO INNOVATION Final Report
Dave G. Soergel 18 Apr. 1977 32 p ref
(NSF Order 77-SP-0443)
(PB-266765/7) Avail: NTIS HC A03/MF A01 CSCL 05A

A system of reporting Federal funding of research and development (R&D) which is based on the design progression phases of the innovative process is presented. The study is limited to investigation of federally funded R&D resource expenditures in hardware production areas. The conceptual approach to design progression reporting is based on six supply-oriented design progression phases within the innovative process and a demand-oriented category of mission needs and goals which is delineated through six mission levels. Current Federal R&D resource data for the solar electric technology mission is realigned to this conceptual framework. GRA

N77-32010# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
STANDARDIZATION GUIDE FOR CONSTRUCTION AND USE OF MORT-TYPE ANALYTIC TREES
J. R. Buys Feb. 1977 34 p refs
(Contract EY-76-C-07-1570)
(ERDA-45/8; SSDC-8) Avail: NTIS HC A03/MF A01

A system is proposed to develop and teach the use and construction of MORT (Management Oversight and Risk Tree) diagrams and other analytic trees. The guide seeks to correct a problem in lack of standardization and is equally applicable to both success or positive trees, and failure, fault, or negative trees. Author

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N77-32011# Metcut Research Associates, Inc., Cincinnati, Ohio.
INFORMATION RETRIVAL AND INCREASED DATA STORAGE OF MACHINABILITY DATA CENTER Annual Report, 1 Aug. 1975 - 31 Dec. 1976
John F. Kahles and John L. Krebs Feb. 1977 52 p refs
(Contract DSA900-75-C-2071)
(AD-A039021; AMMRC-CTR-77-10; AR-12) Avail: NTIS HC A04/MF A01 CSCL 05/2

Machinability Data Center (MDC) operations during this contract period resulted in an addition of 2,140 documents to the hard-copy document file with a net increase of 1,677 documents after deleting obsolete references. MDC's document files as of December 1976 included 35,183 holdings. During the period of this report, 4,044 copies of MDC publications were sold. This number includes 2,263 copies of the 2d Edition of the Machining Data Handbook, 1,203 copies of the newly issued publications and 578 copies of MDC publications developed under prior DoD contracts. Additionally, 9 computer programs and 11 programmable calculator strips pertaining to the economics of machining were sold. A total of 292 inquiries were processed during this report period with emphasis on machining of high temperature alloys and nontraditional machining methods. MDC's seminar program 'Practical Machining Principles for Shop Application' continued to be a highly successful means of disseminating machining information. This program attracted 630 attendees from government and industry, bringing the totals for 39 seminars to 1,188 attendees from 589 companies located in 40 states. The seminars will be continued during the next contract period. Author (GRA)

N77-32012# Northrop Corp., Hawthorne, Calif. Aircraft Div.
WAVE DRAG REDUCTION FOR AIRCRAFT FUSELAGE-WING CONFIGURATIONS. VOLUME 1: ANALYSES AND

RESULTS Final Report, 30 Jun. 1975 - 30 Oct. 1976
C. W. Chu, J. Der, Jr., and H. Ziegler Warminster, Pa. NADC Oct. 1976 143 p refs
(Contract N62269-75-C-0537)
(AD-A040997; NOR-76-190-Vol-1; NADC-77157-30-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 05/2

An optimization procedure has been developed to minimize the wave drag of an aircraft fuselage-wing configuration subject to constraints imposed by design requirements. The theory, methods, computer programs and results are presented in this report in two volumes. This volume describes analyses, results and the optimization procedure. The procedure makes use of the Latin Square sampling technique and the Three-Dimensional Method of Characteristics. The former is used to efficiently sample the family of configurations, and the latter is used to accurately calculate the wave drags of the sampled configurations. The calculated wave drag coefficients are then used to derive a functional dependence of the wave drag on the geometric variables that define the family of configurations. The minimum wave drag configuration can be obtained by minimizing the wave drag function subject to a given set of constraints. The wave drag reduction procedure is demonstrated using an F-4 type configuration as the baseline. The results are presented and discussed. GRA

N77-32013# Northrop Corp., Hawthorne, Calif.
WAVE DRAG REDUCTION FOR AIRCRAFT FUSELAGE-WING CONFIGURATIONS. VOLUME 2: MANUAL FOR COMPUTER PROGRAMS Final Report, 30 Jun. 1975 - 30 Oct. 1976
C. W. Chu, J. Der, Jr., and H. Ziegler Oct. 1976 379 p
(Contract N62269-75-C-0537)
(AD-A040998; NOR-76-190-Vol-2; NADC-77157-30-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 05/2

An optimization procedure has been developed to minimize the wave drag of an aircraft fuselage-wing configuration subject to constraints imposed by design requirements. The theory, methods, computer programs and results are presented in this report in two volumes. This volume is the user's manual for the computer programs. The input/output information is described in detail. Listings of the programs are given, and samples of built-in program diagnostic messages are explained. Also included are the logical structures of the programs and the descriptions of the subroutines, which in combination with the program listings can be used for possible future modification, improvement, or extension of these computer programs. GRA

N77-32014# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
BROWSER: A USER ORIENTED INFORMATION RETRIEVAL SYSTEM
Forrest Paul Conrad Dec. 1976 46 p refs
(Contract N00014-75-C-0612)
(AD-A040637; T-38) Avail: NTIS HC A03/MF A01 CSCL 09/2

The BROWSER system was designed as a tool to aid in problem isolation, problem measurement and revision monitoring in the maintenance of aircraft by the U.S. Navy. This paper discusses how BROWSER's design accomplishes these goals. Since the overall system would require man-years to complete, only crucial sections of the code were implemented to demonstrate the system's feasibility. Since simplicity was a paramount design principle, it is not anticipated that expansion of the system will encounter extraordinary problems. Note however that the design process is an iterative one. BROWSER is a complex information retrieval system. The user interacts with the system in real time through a computer terminal. This is to be differentiated from retrieving the data on a real time basis. The data base which BROWSER operates on is so large that a majority of it resides on magnetic tape. The period of processing may span several days during which time the user can perform unrelated work. After processing the query, BROWSER notifies the user upon completion. GRA

N77-32015# Yale Univ., New Haven, Conn. Dept. of Computer Science.
THE PROCESS OF QUESTION ANSWERING Ph.D. Thesis
Wendy G. Lehnert May 1977 296 p refs
(Contract N00014-75-C-1111)
(AD-A040559; RR-88) Avail: NTIS HC A13/MF A01 CSCL 05/10

Problems in computational question answering assume a new perspective when question answering is viewed as a problem in natural language processing. A theory of question answering has been proposed which relies on ideas in conceptual information processing and theories of human memory organization. This theory of question answering has been implemented in a computer program, QUALM, currently being used by two story understanding systems to complete a natural language processing system which reads stories and answers questions about what was read. The processes in QUALM are divided into 4 phases: (1) Conceptual categorization which guides subsequent processing by dictating which specific inference mechanisms and memory retrieval strategies should be invoked in the course of answering a question; (2) Inferential analysis which is responsible for understanding what the questioner really meant when a question should not be taken literally; (3) Content specification which determines how much of an answer should be returned in terms of detail and elaborations, and (4) Retrieval heuristics which do the actual digging to extract an answer from memory. GRA

N77-32016# Battelle Pacific Northwest Labs., Richland, Wash.
ENFORM: AN ENERGY INFORMATION SYSTEM
C. M. Heeb, W. L. Purcell, and B. M. Cole Mar. 1977 59 p refs
(Contract EY-76-C-06-1830)
(BNWL-2195) Avail: NTIS HC A04/MF A01

The ENFORM system of computer codes can be used to calculate the amount of fuel material in the nuclear fuel cycle as a function of time. The material amounts are determined by an input schedule of installed electric energy generation capacity. In addition to the amount of uranium and plutonium in the fuel cycle, the system also accounts for 175 radionuclides. The chemical effluents released to the environment are modeled by using simple release factors. All release factors and dose coefficients are specific for each type of plant in the nuclear fuel cycle. The material logistics and effluent accounting features of the ENFORM system are supplemented by a fuel cycle economics package. This module provides fuel cycle processing costs and the levelized cost of power. The ENFORM system also provides means of estimating the effect of changing nuclear growth scenarios and changing environmental control technologies on nuclear fuel cycle effluents, economics and logistics. ERA

N77-32017# Department of Defence, Canberra (Australia). Scientific and Technical Information Branch.
STORAGE, RETRIEVAL AND DISSEMINATION OF INFORMATION: CURRENT DEVELOPMENTS
J. Clarke Aug. 1976 37 p refs
(AD-A040995; STIB-2/76) Avail: NTIS HC A03/MF A01 CSCL 05/2

This paper provides a literature survey of current developments in storage, retrieval and dissemination of information and associated technologies, with assessment of their application to the Australian Department of Defence. Eighty references are included. GRA

N77-32018# Adjutant General Center, Washington, D. C.
IMPLEMENTATION OF MICROPUBLISHING, ARMY CONCEPT AND TECHNOLOGY (IMPACT), APPENDICES Final Report, Feb. 1975 - Feb. 1977
Robert T. Allsop, Michael A. Carpentier, Andrew N. Carras, Harry L. Chipman, and Gordon E. Grant Feb. 1977 265 p
(AD-A040783; MP-77-1-App) Avail: NTIS HC A12/MF A01 CSCL 14/5

Partial Contents: HQDA Publishing System Workflow; Cost Benefit Analysis On a Prototype Micropublishing System Compared to Similar Hard Copy Printing On the Present Publishing System; Micrographics Reconnaissance Activities; New Start Exception Process; TAG Approval of In-House COM - Based Prototype; Field Testing of Micropublications for Usability and Acceptability Within Brigade Level Functions; Field Test Program Microfiche Readers; Microfiche Reader Distribution; Fiche Factors Evaluation; Project IMPACT User Debriefing; and DACA-CAF Methodology Concurrence Report and IGAA-ECD Audit of Cost Benefit Analysis Report. GRA

N77-32019# Adjutant General Center, Washington, D. C.
IMPLEMENTATION OF MICROPUBLISHING, ARMY CONCEPT AND TECHNOLOGY (IMPACT) Final Report, Feb. 1975 - Feb. 1977
Robert T. Allsop, Michael A. Carpentier, Andrew N. Carras, Harry L. Chipman, and Gordon E. Grant Feb. 1977 136 p
(AD-A040782; MP-77-1) Avail: NTIS HC A07/MF A01 CSCL 14/5

This report addresses the development of a micropublishing system which reduces publications costs and increases user acceptability. Current and proposed publications systems are described. Extensive attitude surveys and user field tests document the desirability of providing DA publications in the microfiche medium as a supplement to and/or replacement of hard copy publications. An actual operational prototype micropublishing system is described in detail and various alternative subsystems are presented. A micropublishing system is recommended for implementation. Author (GRA)

N77-32020# Stanford Univ., Calif. Dept. of Computer Science.
A TRIVIAL ALGORITHM WHOSE ANALYSIS ISN'T
Arne T. Jonassen and Donald E. Knuth Mar. 1977 35 p refs
(Contracts N00014-76-C-0330; N00014-75-C-0661)
(AD-A040486; SU-STAN-CS-77-598) Avail: NTIS HC A03/MF A01 CSCL 09/4

Very few theoretical results have been obtained to date about the behavior of information retrieval algorithms under random deletions, as well as random insertions. The present paper offers a possible explanation for this dearth of results, by showing that one of the simplest such algorithms already requires a surprisingly intricate analysis. Even when the data structure never contains more than three items at a time, it is shown that the performance of the standard tree search/insertion/deletion algorithm involves Bessel functions and the solution of bivariate integral equations. A step-by-step expository analysis of this problem is given, and it is shown how the difficulties arise and can be surmounted. Author (GRA)

N77-32021# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.
KSPLIB, CHARACTER STRING PROCESSING LIBRARY ROUTINES, USER MANUAL Final Report
Bruce D. Carbrey Apr. 1977 74 p
(AD-A040207; MISD-UM-77-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes a set of general-purpose, FORTRAN-callable functions and subroutines for manipulating character-strings. Character-strings of arbitrary length can be treated as simple (non-dimensioned) variables. Functions are provided for string definition, string concatenation, substring extraction, string comparison, pattern matching and searching, numeric-string/string-numeric conversions, string input/output, and other tasks. The routines described are moderately system-dependent, and are currently available as an object program library on the cdc 6500/6600 computers at the Arradcom Dover, New Jersey site. Author (GRA)

N77-32022# Yale Univ., New Haven, Conn. Dept. of Computer Science.
SKIMMING NEWSPAPER STORIES BY COMPUTER
Gerald F. DeJong May 1977 35 p refs
(Contract N00014-75-C-1111)
(AD-A040560; RR-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes a program that takes a novel approach to understanding natural language. Its domain is newspaper articles and it is unique in that it skims the stories rather than reading them carefully. The program is able to understand the important facts in an article while ignoring the less important text. Author (GRA)

N77-32023# Navy Personnel Research and Development Center, San Diego, Calif.
VISUAL SEARCH TIMES FOR NAVY TACTICAL INFORMATION DISPLAYS Final Report
James R. Callan, L. E. Curran, and Jeneva L. Lane May 1977 23 p refs
(AD-A040543; NPRDC-TR-77-32) Avail: NTIS HC A02/MF A01 CSCL 05/8

An experiment was conducted to determine the time and accuracy with which an operator could find target items in each of six preformatted information displays. The displays corresponded to two versions (long and short) of three CRT formats proposed for the Naval Tactical Data System (NTDS). The number of items on the displays ranged from 6 to 40. Operators were tasked to retain either a two- or four-consonant letter set in memory during the search task. Following a fixed time to perform the search, single letter probes were presented to determine that the memory set had been maintained. Total amount of information on the display was the only relevant factor of those examined. Future effort should be concentrated on different search requirements, scan patterns, display area segregation, and practice or operator skill level. GRA

N77-32024# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF 14TH CONTU MEETING
May 1977 121 p Meeting held at Arlington, Va., 5 May 1977
(PB-267332/5; CONTU-77-0004) Avail: NTIS HC A06/MF A01 CSCL 05B

Reports concerning copyright protection for computer programming and for automated data bases are presented. Suggestions were made for amending the reports and circulating the amended versions. A request was made for additional guidelines to interprete further terms in section 108 of the new copyright revision law. GRA

N77-32025# Pattern Analysis and Recognition Corp., Rome, N. Y.
STATISTICAL METHODS FOR TECHNICAL DOCUMENT RETRIEVAL Final Technical Report
Harry M. Hersh, John M. Morris, Katherine J. Morris, and James R. Wilson Jun. 1977 86 p refs
(Contract F30602-76-C-0135)
(AD-A041845; PAR-77-8; RADC-TR-77-217) Avail: NTIS HC A05/MF A01 CSCL 05/2

The RADC Automatic Document Classification On-Line (RADCOL) system is a tool for testing various statistical procedures for document analysis and retrieval, and for the design of operational systems. This report describes experiments which used the RADCOL system; it was found, as had been predicted, that procedures for clustering word stems did not provide substantial savings in space and time, and that an unclustered thesaurus gave improved retrieval capabilities. Three new versions of the system were implemented, with weights of 0.0, 0.5, and 1.0 assigned to identity correlations (correlations of word stems with themselves). Because of superior performance of the system using 1.0 correlations, a simplified version of the retrieval technique was recommended for use with science and technology abstracts. In the simplified system, automatic thesaurus generation would be eliminated, and a large technical vocabulary would be used. Retrievals would use direct correlations between queries and documents. These experiments are believed to be the most comprehensive series of tests of statistical retrieval methods performed on a data base of realistic size. Further experimentation is recommended to determine the applicability of statistical methods to other types of intelligence data bases and user requirements. GRA

N77-32026# National Bureau of Standards, Washington, D. C.
DIMENSIONS, VOLUME 61, NO. 4 Monthly Report
Apr. 1977 37 p
(PB-267477/8; NBS/DIM-61/4) Avail: NTIS HC A03/MF A01 CSCL 14B

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Television watching could become meaningful; Out of the classroom, into the laboratory; New device aids deep ocean research; The state of NBS; NBS, aluminum association, and American electroplaters' society form program; NBS cryogenic flow measurement code approved; New technique for dental

restorations; New calorimeter unit measures high laser energy; Use of vibrational spectroscopy for NDE; New standard reference materials to aid research on role of chromium on nutrition; Materials and space flight conference; Thermophysical properties symposium; Weights and measures standards of the United States, a brief history. GRA

N77-32027# National Bureau of Standards, Washington, D. C.
DIMENSIONS, VOLUME 61, NO. 5 Monthly Report
May 1977 35 p refs
(PB-267321/8; NBS/DIM-61/5) Avail: NTIS HC A03/MF A01 CSCL 14B

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Going to extremes in the study of sound; Things your mother never told you about spinach; liquefied natural gas; NBS issues landmark study on privacy in health records; Resource conservation and recovery; Standards for law enforcement; measurements of earth's motion agree with general relativity theory; Limits of hydrogen liquefier efficiency defined; NBS microcopy resolution test chart SRM accepted for international use; polyethylene proposed for biocompatibility studies; Reference data report; Telecommunications technology and libraries conferences; ACM/NBS systems and software symposium; New SRM price list available from NBS; is hydrogen safe; Thermophysical properties data published. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-32028# Rochester Univ., N. Y. Graduate School of Management.
PRIORITY PRICING MODELS FOR CONGESTED SYSTEMS Final Report
Robert Joseph Dolan Feb. 1977 120 p refs
(Grant NSF NM-44241)
(PB-267164/2; Working Paper Ser-7710) Avail: NTIS HC A06/MF A01 CSCL 05C

A priority pricing mechanism was constructed such that a user maximizes his individual welfare, minimizes his expected waiting time costs plus priority payment by providing unbiased estimates of the parameters required by the system administrator. The pricing mechanism is based on the expected marginal delay cost which a user's service imposes on other users of the service facility. The analysis is not based on steady state assumptions. GRA

N77-31197*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAINTENANCE AND OPERATIONS COST MODEL FOR DSN SUBSYSTEMS
R. W. Burt and J. R. Lesh *In its* The Deep Space Network 15 Aug. 1977 p 91-96 ref (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 05C

N77-31199*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIFE-CYCLE COSTING: PRACTICAL CONSIDERATIONS
I. Eisenberger and G. Lorden *In its* The Deep Space Network 15 Aug. 1977 p 102-109 refs (For primary document see N77-31186 22-12)
Avail: NTIS HC A10/MF A01 CSCL 05C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-32029# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1978, PART 3
Washington GPO 1977 417 p refs Hearing on S. 365 before Subcom. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 1st Sess., 7, 9, 17-18 Mar. 1977
(GPO-86-914) Avail: Subcomm. on Sci., Technol., and Space

NASA programs in aeronautical research and development are described to justify budgetary requests for FY-1978. Included are statements on NASA programs and policies by members of the civil aviation industry. G.D.H.

N77-32030# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1978, PART 4: INDEX
Washington GPO 1977 116 p Hearings on S. 365 before Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 1st Sess., 1977
(GPO-93-414) Avail: Subcomm. on Sci., Technol., and Space

Research in solar terrestrial relationships with emphasis on the earth's atmosphere is included in this index of hearings which appropriate funds to NASA for research and development, construction of facilities, and research and program management. B.L.P.

N77-32031# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1978, VOLUME 1, PART 2
Washington GPO 1977 1224 p refs Hearings on H.R. 2221 (superseded by H.R. 4088) before Subcomm. on Space Sci. and Applications of the Comm. on Sci and Technol., 95th Congr., 1st Sess., 2, 4-7, and 9 Feb. 1977
(GPO-92-082) Avail: Subcomm. on Space Sci. and Applications

NASA's Office of Space Flight programs are described in support of funding requests and appropriations for FY-1978. Testimony given in field hearings at the Kennedy, Johnson, Marshall and Michoud facilities is documented. A.R.H.

N77-32032# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1978, VOLUME 1, PART 3
Washington GPO 1977 933 p refs Hearings on H.R. 2221 (superseded by H.R. 4088) before the Suncomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., 16-17, 23 Feb. and 4-6, 7 Mar. 1977
(GPO-92-294) Avail: Subcomm. on Space Sci. and Applications

Present and planned programs for basic scientific exploration and applications of practical technology in space are explored in testimony presented by representatives of various organizations and NASA offices. Field hearings at Rockwell International, the Jet Propulsion Laboratory, McDonnell Douglas, and the Boeing Aerospace Co. are included. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N77-32033*# Detroit Diesel Allison, Indianapolis, Ind.
STUDY AND PROGRAM PLAN FOR IMPROVED HEAVY DUTY GAS TURBINE ENGINE CERAMIC COMPONENT DEVELOPMENT Final Report
H. E. Helms May 1977 161 p refs Sponsored by ERDA (Contract NAS3-20064)
(NASA-CR-135230; EDR-9068; ERDA/NASA/3-20064/77/1)
Avail: NTIS HC A08/MF A01 CSCL 13F

Fuel economy in a commercially viable gas turbine engine was demonstrated through use of ceramic materials. Study results show that increased turbine inlet and generator inlet temperatures, through the use of ceramic materials, contribute the greatest amount to achieving fuel economy goals. Improved component efficiencies show significant additional gains in fuel economy.
Author

N77-32034# Defense Intelligence Agency, Washington, D.C.
ELECTRIC VEHICLE RESEARCH, DEVELOPMENT, AND TECHNOLOGY, FOREIGN
James D. Busi and Lawrence R. Turner May 1977 207 p refs
(AD-A040526; DST-1850S-403-77) Avail: NTIS HC A10/MF A01 CSCL 13/6

The development and production of electric drive vehicles have been successful in the Federal Republic of Germany, Japan, the United Kingdom, USSR, and, to a lesser degree, in France, Italy, and Sweden. These vehicles are basically designed for commercial or industrial application, and, in general, a typical vehicle of this type has a maximum range of 95 to 200 km and a maximum speed of 27 km/h. Military applications of electric drive vehicles for transportation and combat are significant because they offer a number of advantages over more conventional drive systems. GRA

N77-32035# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
PROCESSING OF RAW SEWAGE BY ULTRA-FILTRATION
L. R. Harris and C. M. Adema Apr. 1977 19 p refs
(AD-A041607; MAT-77-79) Avail: NTIS HC A02/MF A01 CSCL 13/2

To meet discharge regulations for marine sanitation devices, the Navy has examined various state-of-the-art processes. One of the newer technologies is ultrafiltration, a pressure-driven membrane process. A microfiltration and nine ultrafiltration systems were evaluated for their effectiveness in processing raw sewage while producing an effluent that could meet the discharge requirements. Four filtration configurations--tubular, hollow fiber, spiral wound, and plate and frame -- were tested. Pretreatment and cleaning requirements for each system were established. Each system was compared in terms of relative flux decline, maintenance, rejection of fecal coliform, and suspended solids. All systems produced an effluent, meeting the Jan. 1980 effluent standard requirement for suspended solids content; and all but two met the requirement for fecal coliform bacteria density. It was recommended that further tests be conducted with a noncellulosic 1-inch inside diameter tubular membrane and a hollow fiber membrane system, coupled to a biological oxidation process and compared with a previously-evaluated plate and frame membrane design. GRA

N77-32036# Oak Ridge National Lab., Tenn. Regional and Urban Studies Section.
TRANSPORTATION ENERGY CONSERVATION DATA BOOK, SUPPLEMENT 2
D. B. Shonka Feb. 1977 79 p refs Supplement to ORNL-5918
(Contract W-7405-eng-26)
(ORNL-5247-Suppl-2) Avail: NTIS HC A05/MF A01

Tables, graphs; and other visuals are used to present statistical data on energy use and related activity of the transportation sector. Data in this supplement concentrate on personal travel characteristics and fuel economy options for automobiles. A list of references is provided and an annotated bibliography and glossary is included. ERA

N77-32037# Monsanto Research Corp., Dayton, Ohio.
DISPOSAL STUDY (TIRES AND OTHER POLYMERIC MATERIALS) Final Report
W. H. Hadley, T. E. Ctvrtnicek, and W. J. Search Aug. 1976 148 p refs
(Contract DAAK03-74-C-0136)
(AD-A039453; MRC-DA-478; NARADCOM-TR-76-25-FSL) Avail: NTIS HC A07/MF A01 CSCL 13/6

The purpose of this study was to evaluate the technical and economic feasibility of various methods of tire disposal. Over thirty processes for the disposal of tires and their interrelationships were investigated. The following four promising process alternatives involving combinations of these processes were recommended for further investigation: (1) mechanical shearing followed by incineration, (2) landfill after mechanical shearing, (3) use in asphalt substances after the combined size reduction processes (mechanical shredding followed by cryogenic shredding), and (4) selling the by-products of the combined size reduction processes. Author (GRA)

N77-32038# Army Medical Intelligence and Information Agency, Washington, D. C.
EXAMINATION OF THE PROBLEM OF RECUPERATIVE TREATMENT OF WASTE WATER IN THE CHEMICAL INDUSTRY
I. V. Robu Apr. 1977 22 p Transl. into ENGLISH from Revista de Chimie (Romania), v. 17, no. 10, 1966 p 627-635
(AD-A039230; USAMIIA-K-7088) Avail: NTIS HC A02/MF A01 CSCL 13/2

In what follows the simplest technology -- a fractionating column having only a stripping section and heated by direct steam -- will be used to derive the general relationship among the main variables of the process of separation by fractionation and recovery of an organic substance dissolved in water. An analytical relation among these variables is established in what follows on the basis of the law obeyed by dilute solutions of organic substances (the solute) which are difficultly soluble in water (the solvent). GRA

N77-32039# Arizona Univ., Tucson.
MOVEMENT OF SELECTED METALS, ASBESTOS AND CYANIDE IN SOIL: APPLICATIONS TO WASTE DISPOSAL PROBLEMS Final Report
Wallace H. Fuller Apr. 1975 259 p refs
(Contract EPA-68-03-0208)
(PB-266905/9; EPA-600/2-77-020) Avail: NTIS HC A12/MF A01 CSCL 13B

Information is given on movement of selected hazardous substances in soil which can be applied to problems of selecting and operating land disposal sites for wastes containing arsenic, asbestos, beryllium, cadmium, chromium, copper, cyanide, iron, lead, mercury, selenium, and zinc. The information is based on a literature review, laboratory studies of movement of hazardous substances through soil in municipal landfill leachate, and the author's experience in soil science and waste disposal. In addition to a discussion of the soil and waste-related factors to be considered in selecting and managing disposal sites for minimum migration hazard, the report also presents general information on soils and geological materials and specific information on the chemistry of the selected hazardous substances which is relevant to an understanding of their migration in soil. GRA

N77-32040# Department of Transportation, Washington, D.C. Office of the Secretary.
TOWARD 2000: OPPORTUNITIES IN TRANSPORTATION EVOLUTION
J. D. Ward, K. L. Oleary, B. Bartholow, S. C. Chu, and A. B. Linhares Mar. 1977 155 p
(PB-266763/2; DOT-TST-77-19) Avail: NTIS HC A08/MF A01 CSCL 13B

Possible directions are described for the Nation's transportation system evolution, and research and development strategies are identified to take advantage of the most promising opportunities. A brief examination of population and demographic trends are given, and some conjectures about the future are made. Transportation opportunities in five major areas are examined: urban transportation, intercity transportation, the private automobile, freight-systems, and cross-cutting issues such as decision-making. Also included are general discussions of the relationships among transportation changes in the spatial organization of the nation (land use), and the use of resources: energy, labor, and capital. GRA

N77-32041# Environmental Protection Agency, Washington, D.C.
COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES, 1976 NEEDS SURVEY. VOLUME 1 Cost Report, 1976
James A. Chamblee 10 Feb. 1977 86 p

(PB-266717/8; EPA-430/9-76-010-Vol-1) Avail: NTIS HC A05/MF A01; also avail. in set of 3 reports, PCE09, PB-266716-SET CSCL 13B

Included in the report are a detailed estimate of the cost of construction of all needed publicly-owned treatment works in all of the States and the cost of construction of all needed publicly-owned treatment works in each of the States, to meet the 1983 goals of the FWPCA. The cost estimates presented in this Survey may serve as a basis for Congressional allotment of funds in accordance with the provisions of the Act. GRA

N77-32042# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES. VOLUME 2: SUMMARIES OF TECHNICAL DATA CATEGORIES 1-4, 1976 NEEDS SURVEY Technical Report, for 1976

James A. Chamblee 10 Feb. 1977 87 p

(PB-266718/6; EPA-430/9-76-011-Vol-2) Avail: NTIS HC A05/MF A01; also avail. in set of 3 reports, PCE09, PB-266716-SET CSCL 13B

The Report is a part of the 1976 Needs Survey report and is a supplement to the Cost Estimate Report to the Congress. It provides summaries of detailed technical and cost data reported in the Survey for Categories I through IV. Appendix I provides a description of the conduct of the 1976 Needs Survey as follows. Category I - Secondary Treatment and Best Practicable Wastewater Treatment Technology; Category II-More Stringent Treatment; Category IIIA - infiltration/inflow Correction; Category IIIB - Sewer System Replacement and/or Major Rehabilitation; Category IVA-New Collectors and Appurtenances; Category V - Correction of Combined Sewer overflow; Category VI - Treatment and/or Control of Stormwater. GRA

N77-32043# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES. VOLUME 3: SUMMARIES OF TECHNICAL DATA FOR COMBINED SEWER OVERFLOWS AND STORMWATER DISCHARGE, 1976 NEEDS SURVEY

James A. Chamblee 10 Feb. 1977 401 p refs

(PB-266719/4; EPA-430/9-76-012-Vol-3) Avail: NTIS HC A18/MF A01; also avail. in set of 3 reports, PCE09, PB-266716-SET CSCL 13B

The 1976 Needs Survey for Category V (correction of combined sewer overflows) and Category VI (treatment and/or control of stormwater discharges) was developed using a well defined consistent nationwide methodology. The Needs Survey developed current and 1990 capital and annual operation and maintenance cost estimates to attain three water quality criteria: Aesthetics, Fish and Wildlife and Recreation. A computer model, called the Needs Estimation Model for Urban Runoff, was developed of a detailed analysis of ten specific urbanized areas. The model calculates the combined sewer and stormwater control needs for each urbanized area. These estimates are then summed on a state and territory basis to provide the national estimated needs for Category V and VI. The methodology provides a reasonable and well defined estimate of the eligible costs for water quality control required by combined sewer overflows and stormwater runoff. GRA

N77-32044# Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

FEDERAL GUIDELINES: STATE AND LOCAL PRETREATMENT PROGRAMS. VOLUME 1

Jan. 1977 196 p

(PB-266781/4; EPA-430/9-76-017a-Vol-1) Avail: NTIS HC A09/MF A01; also avail. in set of 3 reports PCE11, PB-266708-SET CSCL 13B

Guidelines were developed by the Environmental Protection Agency in accordance with Section 304(f) of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92500) for the purpose of assisting States and municipalities in carrying out programs under Section 402 including NPDES permit requirements. The guidelines are a revision of the previous guidelines, 'Pretreatment of Pollutants Introduced Into Publicly Owned Treatment Works.' Contained in this revision is additional technical information on pollutants which may interfere with or pass through publicly owned treatment works. Also, guidance is presented to assist State and local governments in developing their own pretreatment programs to comply with NPDES permit conditions. GRA

N77-32045 Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

FEDERAL GUIDELINES: STATE AND LOCAL PRETREATMENT PROGRAMS. VOLUME 2: APPENDIXES 1-7

Jan. 1977 240 p refs

(PB-266782/2; EPA-430/9-76-017b-Vol-2) Avail: NTIS HC A11/MF A01; also avail. in set of 3 reports PCW11, PB-266780-SET CSCL 13B

For abstract, see N77-32044.

N77-32046 Environmental Protection Agency, Washington, D.C. Municipal Construction Div.

FEDERAL GUIDELINES: STATE AND LOCAL PRETREATMENT PROGRAMS. VOLUME 3: APPENDIX 8

Jan. 1977 419 p

(PB-266783/0; EPA-430/9-76-017c-Vol-3) Avail: NTIS HC A18/MF A01; also avail. in set of 3 Reports PCE11, PB-266780-SET CSCL 13B

Guidelines were developed by the Environmental Protection Agency in accordance with Section 304(f) of the Federal Water Pollution Control Act Amendments of 1972 for the purpose of assisting States and municipalities in carrying out programs under Section 402 including NPDES permit requirements. The guidelines are a revision of the previous guidelines. 'Pretreatment of Pollutants Introduced Into Publicly Owned Treatment Works.' Contained in this revision is additional technical information on pollutants which may interfere with or pass through publicly owned treatment works. Also, guidance is presented to assist State and local governments in developing their own pretreatment programs to comply with NPDES permit conditions. GRA

N77-32047# IR and T, Arlington, Va.

IMPACTS OF MATERIAL SUBSTITUTION IN AUTOMOBILE MANUFACTURE ON RESOURCE RECOVERY. VOLUME 2, APPENDICES A-E Final Report

Roy Renner, Robert W. Roig, T. Jones, and C. Weaver Jul. 1976 168 p refs

(Contract EPA-68-01-3142)

(PB-267568/4; IRT-403-R-Vol-2; EPA-600/5-76-007b) Avail: NTIS HC A08/MF A01 CSCL 13B

Future trends in materials composition of the automobile were quantified, and possible constraints related to material characteristics, availability, and price were examined. The automobile resource recovery industry was studied in terms of economic incentives for recycling and technical obstacles to recycling of deregistered automobiles. A macro-model of the economy was used to study overall economic and environmental effects and to bring to light any secondary effects that might be important. This volume contains appendices covering the following subjects: (1) Future Material Composition in Automobiles; (2) Projections of Automobile Sales by Weight Class; (3) Automotive Use of Plastics and Recycling Possibilities; (4) Safety Aspects of Materials Substitution; (5) Energy Consequences. GRA

N77-32048# IR and T, Arlington, Va.

IMPACTS OF MATERIAL SUBSTITUTION ON RESOURCE RECOVERY. VOLUME 3, APPENDICES F-G Final Report

W. L. Henn and Andrea L. Watson Jul. 1976 115 p refs

(Contract EPA-68-01-3142)

(PB-267569/2; IRT-403-R-Vol-3; EPA-600/5-76-007c) Avail: NTIS HC A06/MF A01 CSCL 13B

Appendices are given covering the following subjects: (1) Future Scrap Requirements and Prospects for Automotive Recycling; (2) Demand, Availability, and Price of Steel and Substitute Materials for Automobile Manufacture. GRA

N77-32049# IR and T, Arlington, Va.

IMPACTS OF MATERIAL SUBSTITUTION IN AUTOMOBILE MANUFACTURE ON RESOURCE RECOVERY. VOLUME 4, APPENDICES H-J Final Report

W. L. Henn, Robert W. Roig, and Andrea L. Watson Jul. 1976 90 p refs
(Contract EPA-68-01-3142)
(PB-267570/0; IRT-403-R-Vol-4; EPA-600/15-76-007d-Vol-4)
Avail: NTIS HC A05/MF A01 CSCL 13B

Probable changes in the mix of materials used to manufacture automobiles were examined to determine if economic or technical problems in recycling could arise such that the abandoned automobile problem would be resurrected. Future trends in materials composition of the automobile were quantified, and possible constraints related to material characteristics, availability, and price were examined. The automobile resource recovery industry was studied in terms of economic incentives for recycling and technical obstacles to recycling of deregistered automobiles. A macro-model of the economy, the EPA sponsored SEAS model, was used to study overall economic and environmental effects and to bring to light any secondary effects that might be important. Appendices are presented. Author

N77-32050# State Univ. of New York, Syracuse. Coll. of Environmental Science and Forestry.
TESTING EMERGING LAND USE CONCEPTS IN AN URBANIZING REGION. TDR: HYPOTHETICAL CASES
R. D. Hennigan, R. M. L. Bellandi, D. L. Whitehead, R. C. Linquist, and B. H. Gorelick 3 Jun. 1977 87 p refs Sponsored in part by Rockefeller Foundation, New York
(PB-267309/3; B24-77-5-31) Avail: NTIS HC A05/MF A01 CSCL 13B

Hypothetical case studies involving three towns in the New York City region are presented. Having previously determined that the success of a transfer of development rights (TDR) system will likely hinge on the marketability of the development rights, an underlying concern of the case studies is the creation of the correct number of development rights. This concern is exhibited in two major areas examined in the studies--the adequate monetary compensation to affected landowners and the municipal service cost implications of development right issurance. As the case studies investigate the feasibility of using TDR in the three towns, an attempt is made to project and predict what may happen in the major areas of examination. GRA

N77-32051# Little (Arthur D.), Inc., Cambridge, Mass.
DESTROYING CHEMICAL WASTES IN COMMERCIAL SCALE INCINERATORS. FACILITY REPORT NO. 2, SURFACE COMBUSTION DIVISION, MIDLAND-ROSS CORPORATION Final Report
J. W. Adams, J. C. Harris, P. L. Levins, J. L. Stauffer, K. E. Thrun, and L. Woodland Dec. 1976 162 p Prepared for TRW Systems, Inc., Redondo Beach, Calif.
(Contract EPA-68-01-2966)
(PB-268232/6; EPA-530/SW-122c.2) Avail: NTIS HC A08/MF A01 CSCL 13B

The effectiveness of pyrolysis was determined for treatment of three selected chemical wastes: petroleum refinery wastes, styrene production wastes, and rubber manufacturing wastes. The average conversion of organic material in the waste to organic material in the gaseous pyrolyzer effluent was 70 percent for refinery waste, 60 percent for styrene waste, and 80 percent for rubber waste. In each case the vapor stream contained a wide variety of organic compounds from methane and acetylene to high boiling aromatic liquids and tars, including appreciable concentration of polynuclear aromatic hydrocarbons. The residual ash in each case was 80 percent inorganic material. Technical and economic feasibilities were discussed. GRA

N77-32052# Virginia Univ., Charlottesville. Dept. of Civil Engineering.
PUBLIC TRANSPORTATION: PROBLEMS AND OPPORTUNITIES
Lester A. Hoel Mar. 1977 93 p refs
(Contract DOT-OS-50233)
(PB-267304/4; DOT-TST-77-39) Avail: NTIS HC A05/MF A01 CSCL 13B

Urban transportation solutions that have been tried or are being proposed in North American cities are presented and specific urban transportation problems are described. The first article examines deficiencies in existing systems, relative use of urban transportation modes, characteristics of transit riders, the peaking problem, and categories of alternatives for improvement. Three other articles examine options for meeting urban transportation needs: rail rapid transit, bus rapid transit, and para-transit. Emphasis is placed on defining the role in urban transportation each option can play and on summarizing system experiences with them. GRA

N77-32053# Tennessee Univ., Knoxville. Transportation Center.
SOLVING PUBLIC PASSENGER TRANSPORTATION PROBLEMS: A NEED FOR POLICY REORIENTATION, VOLUME 2 Final Report
F. W. Davis, Jr. and K. Oen Jan. 1977 34 p refs
(Contract DOT-OST-40096)
(PB-267912/4; DOT-TST-77-35) Avail: NTIS HC A03/MF A01 CSCL 13B

A consumer-oriented approach to mass transportation is presented. Specific individual needs are matched with a broad array of transportation services in order to overcome various barriers to development of new forms of transportation service. J.M.S.

N77-32054# University of Southern Calif., Los Angeles. Dept. of Industrial and System Engineering.
CHARACTERISTICS OF MULTILANE TRAFFIC FLOW FROM AERIAL DATA Final Technical Report, 1975 - 1976
R. Agahi, A. V. Gafarian, P. Jagger, L. T. Nguyen, and J. Pahl Oct. 1976 135 p refs
(Contract DOT-OS-50122)
(PB-267683/1; TR-76-2; DOT-TST-76-T/2) Avail: NTIS HC A07/MF A01 CSCL 13B

A discrete data base, developed from time-lapse photography with a helicopter mounted camera, was used to produce continuous car trajectories showing location, speed, and acceleration as a function of time. Microscopic and macroscopic characteristics of multilane traffic flow were determined from these trajectories. The microscopic results consist of statistical descriptions of the behavior of individual vehicles which are either in a car following situation because they are unable to pass or who are in the process of accepting a gap in an adjacent lane when they are able to change lanes. The macroscopic results consist of statistical descriptions of traffic density which is a bulk parameter representing the number of cars in a given roadway section. GRA

N77-32055# Urban Land Inst., Washington, D. C. Office of Technology Development and Deployment.
PEOPLE MOVER PROFILE
May 1977 36 p
(PB-268335/7; UMTA-MA-06-0081-77-1) Avail: NTIS HC A03/MF A01 CSCL 13B

The project's aim is to demonstrate the benefits of fully automated people mover systems in downtown urban areas. People movers, installed in controlled environments such as airports and recreation parks, have demonstrated that they are proven operational systems. The DPM Project will demonstrate the feasibility of installing a people mover system in the harsher and more demanding environment of our downtown urban areas. The profile is divided into three sections. The first, a narrative overview, briefly discusses the subject of people movers. The second section consists of detailed technical data and photographs of manufacturers and suppliers of existing people mover systems. The third section, the supplementary material, contains a glossary of terms used in this document. GRA

N77-32056# Peat, Marwick, Mitchell and Co., San Francisco, Calif.
BART IMPACTS ON HIGHWAY TRAFFIC AND TRANSIT RIDERSHIP
Alistair Sherret and Henry Fan May 1977 165 p refs Sponsored in part by HUD
(Contract DOT-OST-30176)
(PB-267675/7; DOT-BIP-TM-20-3-76) Avail: NTIS HC A08/MF A01 CSCL 13B

The 71-mile Bay area Rapid Transit (BART) System, serving San Francisco, Oakland, Berkeley, and their suburbs, is the first regional-scale transit system to open in the United States in over 50 years. This report is one of a series assessing the

impacts of BART on transportation and travel in the Bay Area. The report documents what changes in aggregate highway traffic volumes, traffic congestion, bus ridership, and bus services have taken place in the four years since BART started service, and assesses the extent to which these changes may be attributable to BART. GRA

88 SPACE SCIENCES (GENERAL)

N77-32057# Oesterreichische Akademie der Wissenschaften, Vienna.
SPACE ACTIVITY IN AUSTRIA, 1976-1977
18 Jun. 1977 22 p refs Presented at the COSPAR 20th Plenary Meeting and Assoc. Activities, Tel Aviv, 7-18 Jun. 1977
Avail: NTIS HC A02/MF A01

The activities of the Austrian Solar and Space Agency for 1976/77 are reviewed together with the space activities, over the same period, of other Austrian organizations. ESA

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-32058 Wyoming Univ., Laramie.
THE EARLY-TYPE PRE-MAIN-SEQUENCE STARS OF THE ORION NEBULA CLUSTER Ph.D. Thesis
James Ronald Smith 1976 181 p
Avail: Univ. Microfilms Order No. 77-11277

Statistical classes of cluster stars are used to identify the observed early-type pre-main-sequence stars of the Orion Nebula cluster. The Orion Nebula cluster zero-age-main-sequence is identified in the color-magnitude diagrams. For this determination, the cluster standard stars are used which have normal energy distributions and precise spectral types. The cluster OB and AO nonstandard stars is studied. The presence of grain size distributions containing anomalously large grains is proposed to explain both the dark cloud extinction type and the ultraviolet extinction anomaly. The presence of spatially resolvable circumstellar regions with a disk-like shape or containing optically thick condensations is suggested by the excess infrared energy distributions of several stars. An alternate explanation of the cluster evolution state is presented whereby the majority of the observed A-type stars are field stars. Three pre-main-sequence candidates (BR 405, 767, and 884) are identified, all of which have relatively large excess infrared luminosities. Dissert. Abstr.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-32059*# Planetary Science Inst., Tucson, Ariz.
PLANETOLOGICAL INVESTIGATIONS OR INVESTIGATIONS OF SELECTED MARTIAN REGIONS USING PRIMARILY MARINER 9 DATA Final Report
1 Mar. 1977 46 p refs
(Contract NASw-2869)
(NASA-CR-154891) Avail: NTIS HC A03/MF A01 CSCL 03B

Comparative planetological analyses of cratering and geomorphological processes were researched, with emphasis on the Martian surface. Asteroid fragmentation processes and collisional evolution were also investigated. B.L.P.

N77-32060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MARS SURFACE PENETRATOR: SYSTEM DESCRIPTION
Larry A. Manning, ed. Jun. 1977 88 p refs
(NASA-TM-73243; A-7044) Avail: NTIS HC A05/MF A01 CSCL 03B

A point design of a penetrator system for a Mars mission is described. A strawman payload which is to conduct measurements of geophysical and meteorological parameters is included in the design. The subsystems used in the point design are delineated in terms of power, mass, volume, data, and functional modes. The prospects for survival of the rigors of emplacement are described. Data handling and communications plans are presented to allow consideration of the reqdirements placed by the penetrator on the orbiter and ground operations. The point design is technically feasible and the payload selection scientifically desirable. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-32061# Uppsala Ionospheric Observatory (Sweden).
SOLAR FLUX ESTIMATED FROM ELECTRON DENSITY AND ION COMPOSITION MEASUREMENTS IN THE LOWER THERMOSPHERE
Purobi Chakrabarty, D. K. Chakrabarty, and A. K. Saha (Natl. Phys. Lab., New Delhi) Feb. 1977 14 p refs Submitted for publication Sponsored in part by Swed. Inst. Stockholm
(UIO-SR-77-01) Avail: NTIS HC A02/MF A01

Appropriate models of solar flux in X-rays and Extreme Ultra Violet (XEUV) bands are presented in the light of the present status of ion chemistry in the region 90 to 130 km and reliable measurements of reaction rates, electron density, and ion composition. It was found that the EUV-flux of Schmidtke (1976) and the X-ray flux of Manson (1976) give the best agreement between observed and theoretical electron density profiles for low solar activity condition. The observed increase of electron density with solar activity yields increases of EUV-flux by factors of 3 and 6 and of X-ray flux by factors of 2 and 4 for moderate and high solar activity conditions respectively. However, the values of ion composition computed with these fluxes show marked differences from that experimentally observed, the implications of which are discussed. Author (ESA)

N77-32062# Uppsala Ionospheric Observatory (Sweden).
SOLAR ACTIVITY VARIATION OF NITRIC OXIDE IN THE E-REGION AND ITS IMPLICATIONS
Purobi Chakrabarty, D. K. Chakrabarty, and L. Bjoern Mar. 1977 21 p refs Presented at the COSPAR Symp. on Minor Constituents and Excited Species, Philadelphia, Jun. 1976 Submitted for publication Sponsored in part by Swed. Inst. Stockholm and Swed. Board for Space Activities
(UIO-SR-77-02) Avail: NTIS HC A02/MF A01

The solar activity variation of nitric oxide density at 90 to 130 km for mid-latitude daytime condition was examined on the basis of presently known ion-neutral chemistry of odd nitrogens and laboratory measured reaction rates along with transport mechanisms due to eddy and molecular diffusions. It was shown that while nitric oxide increases by factors of 3 to 4 at lower heights in all the models, at higher heights the variation with

solar activity is sensitive to the type of model adopted. It was also seen that all three selected models reproduce the observed electron densities fairly well, but none of the models are able to explain the observed of excited NO to excited oxygen ratio and its variation with solar activity. Author (ESA)

N77-32063# National Center for Atmospheric Research, Boulder, Colo.

A THREE-DIMENSIONAL MODEL OF HIGH-SPEED STREAMS IN THE SOLAR WIND

Victor John Pizzo 1977 295 p refs Prepared in cooperation with Colo. Univ., Boulder, Colo.

(Contract NSF C-760)

(PB-266959/6; NCAR-CT-43) Avail: NTIS HC A13/MF A01 CSCL 03B

A single fluid, nonlinear, adiabatic, 3-D, hydrodynamic numerical model is developed. The global dynamics of steady, corotating solar wind streams in the supersonic flow regime beyond 35 solar radii were studied. GRA

N77-32064# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NUMBER 392. PART 2: COMPREHENSIVE REPORTS. DATA FOR OCTOBER - SEPTEMBER 1976 AND MISCELLANEA

Helen E. Coffey Apr. 1977 42 p

(PB-268661/6; SGD-392-Pt-2; NOAA-77051806) Avail: NTIS HC A03/MF A01 CSCL 03B

Predicted and observed solar and geophysical data for October 1976, September 1976, and Miscellanea are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares, and their effects, magnetic storms, and SID effects. Author

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-32065# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

COMPILATION OF CONTRIBUTIONS TO THE 15TH INTERNATIONAL COSMIC RAY CONFERENCE

J. B. Blake 29 Jul. 1977 40 p refs Conf. held at Plovdiv, Bulgaria

(ATR-77(5461)-6) Avail: NTIS HC A03/MF A01

The origin of heavy-nuclei cosmic radition was discussed, considering the relative abundance of heavy nuclei as evidence of their origin in the rapid neutron capture process of nucleosynthesis. Atmospheric trapping of low-energy cosmic rays was examined and trajectory calculations were made for solar proton access to the synchronous altitude region of the earth's atmosphere. For individual titles, see N77-32066 through N77-32071.

N77-32066# Aerospace Corp., El Segundo, Calif. Space Sciences Labs.

ON THE DEPENDENCE OF r-PROCESS YIELDS UPON EXPERIMENTALLY UNKNOWN NUCLEAR PARAMETERS: ULTRA-HEAVY COSMIC RAY ABUNDANCES

J. B. Blake and D. N. Schramm (Chicago Univ.) *In its* Compilation of Contrib. to the 15th Intern. Cosmic Ray Conf. 29 Jul. 1977 p 1-6 refs (For primary document see N77-32065 22-93)

Avail: NTIS HC A02/MF A01

Calculations of the relative abundances of heavy nuclei (A greater than 180) in the r-process are presented for three different mass laws and two beta-rate formalisms. The implications of these results for the study of ultraheavy cosmic rays are discussed briefly. Author

N77-32067*# Chicago Univ., Ill. Enrico Fermi Inst.

UH COSMIC RAYS: POSSIBLE ORIGIN IN MASSIVE STARS

John P. Wefel, David N. Schramm, and J. Bernard Blake (Aerospace Corp., Los Angeles) *In* Aerospace Corp. Compilation of Contrib. to the 15th Intern. Cosmic Ray Conf. 29 Jul. 1977 p 7-12 refs (For primary document see N77-32065 22-93)

(Grants NsG-7212; NSF AST-76-21707)

Avail: NTIS HC A02/MF A01 CSCL 03B

The origin of the Z greater than 28, ultraheavy, cosmic rays in supernova explosions of massive stars is considered. For Z greater than 70, the UH data is dominated by an r-process source distribution, but for the elements just beyond iron, 29< or = Z less than 36, the data cannot be explained by any single process of nucleosynthesis. This problem is solved naturally in a massive star model by secondary neutron capture reactions occuring during core helium burning and during explosive carbon burning. Interstellar propagation calculations were performed with these episodes of synthesis as source distributions, and the results offer an explanation for the current UH cosmic-ray data. The heavy element synthesis during explosive carbon burning is reexamined using more realistic initial conditions given by the post-helium-burning configuration of the star. Effects of preferential acceleration are considered, and experimental tests are discussed. Author

N77-32068# Aerospace Corp., Los Angeles, Calif. Ivan A. Getting Labs.

THE r-PROCESS PATH IN THE SUPERHEAVY REGION

K. L. Hainebach, J. B. Blake, and D. N. Schramm (Chicago Univ.) *In its* Compilation of Contrib. to the 15th Intern. Cosmic Ray Conf. 29 Jul. 1977 p 13-17 refs (For primary document see N77-32065 22-93)

Avail: NTIS HC A02/MF A01

Theoretical studies indicate that neutron-induced fission may halt the rapid (r) neutron capture process which makes the bulk of solar system material before the superheavy region is reached. However it appears that an r-process proceeding along the neutron drip line could reach the predicted superheavy element region. Such an r-process could not have synthesized the bulk of solar system r-process material. Author

N77-32069# Aerospace Corp., Los Angeles, Calif. Space Science Lab.

ON THE ACCESS OF SOLAR PROTONS TO THE SYNCHRONOUS ORBIT

J. B. Blake and L. M. Friesen *In its* Compilation of Contrib. to the 15th Intern. Cosmic Ray Conf. 29 Jul. 1977 p 18-23 refs (For primary document see N77-32065 22-93)

(F04701-76-C-0077)

Avail: NTIS HC A02/MF A01

Calculations are presented regarding the initial access of the solar protons to the synchronous altitude region following arrival of the solar protons in the vicinity of the earth in interplanetary space. Pitch angle distributions of the first arrival protons in the equatorial plane at the synchronous altitude are presented. Author

N77-32070# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.

A TECHNIQUE TO DETERMINE THE CHARGE STATE OF THE ANOMALOUS LOW-ENERGY COSMIC RAYS

J. B. Blake and L. M. Friesen *In its* Compilation of Contrib. to the 15th Intern. Cosmic Ray Conf. 29 Jul. 1977 24-29 refs (For primary document see N77-32065 22-93)

Avail: NTIS HC A02/MF A01

If the anomalous, low-energy cosmic rays are only singly charged, they can penetrate deeply into the earth's magnetosphere. Ions which reach low-altitude can be further stripped by the residual atmosphere and become stably trapped. Observation of trapped ions thus would indicate that the anomalous cosmic rays are not totally ionized. This trapping process is qualitatively examined. Author

N77-32071# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.

ROCKET ALTITUDE ATMOSPHERIC X-RAYS FROM MAGNTOSPHERIC ELECTRONS AT SUBAURORAL LATITUDES

J. G. Luhmann and J. B. Blake *In its* Compilation of Contrib. to the 15th Intern. Cosmic Ray Conf. 29 Jul. 1977 p 30-35

refs (For primary document see N77-32065 22-93)
Avail: NTIS HC A02/MF A01

Quasitrapped magnetospheric electrons mirroring in the upper atmosphere at low and middle latitudes will generate X-rays by the bremsstralung and K sub alpha line excitation processes. These atmospheric X-rays may contribute a diffuse background to rocket-borne astronomy experiments launched from White Sands, New Mexico and Kauai, Hawaii. Calculations of the atmospheric X-ray spectrum at these launch sites based on observations of quasitrapped electrons indicate that this locally generated flux is comparable to the reported soft X-ray flux below a few KeV. Author

99 GENERAL

No abstracts in this category.

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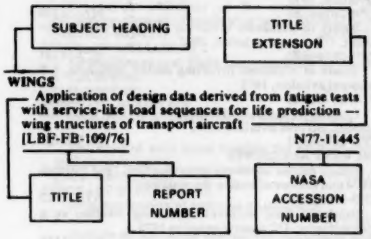

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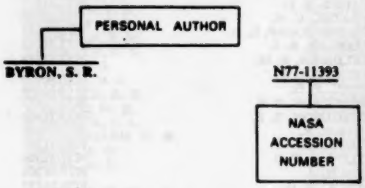

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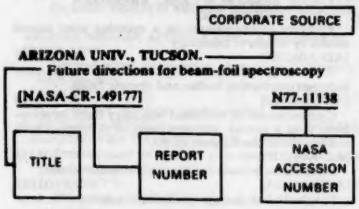

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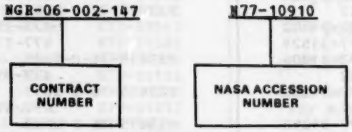

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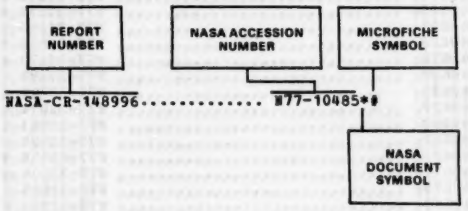

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OSU-CISRC-TR-77-4 ..... N77-31856 #

OT-CR-77-5 ..... N77-31402 #

OTR-77-118 ..... N77-31403 #

OWRT-B-095-MO(5) ..... N77-31286 #

P-60 ..... N77-31738 #
P-1218-PT-2 ..... N77-31129 #
P-5751 ..... N77-31854 #
P-5795 ..... N77-31960 #
P-5802 ..... N77-31873 #

PAR-77-3 ..... N77-31588 #
PAR-77-8 ..... N77-32025 #

PATR-1034-77-3/1 ..... N77-31796 #

PB-255848/4 ..... N77-31552 #
PB-262331/2 ..... N77-31661 #
PB-266162/7 ..... N77-31774 #
PB-266704/6 ..... N77-31659 #
PB-266717/8 ..... N77-32041 #
PB-266718/6 ..... N77-32042 #
PB-266719/4 ..... N77-32043 #
PB-266762/4 ..... N77-31589 #
PB-266763/2 ..... N77-32040 #
PB-266765/7 ..... N77-32009 #
PB-266781/4 ..... N77-32044 #
PB-266782/2 ..... N77-32045 #
PB-266783/0 ..... N77-32046 #
PB-266830/9 ..... N77-31660 #
PB-266883/8 ..... N77-31112 #
PB-266905/9 ..... N77-32039 #
PB-266941/4 ..... N77-31680 #
PB-266951/3 ..... N77-31748 #
PB-266952/1 ..... N77-31749 #
PB-266959/6 ..... N77-32063 #
PB-266960/4 ..... N77-31681 #
PB-266973/7 ..... N77-31402 #
PB-267019/8 ..... N77-31401 #
PB-267068/5 ..... N77-31779 #
PB-267071/9 ..... N77-31778 #
PB-267084/2 ..... N77-31752 #
PB-267107/1 ..... N77-31822 #
PB-267108/9 ..... N77-31750 #
PB-267137/8 ..... N77-31590 #
PB-267164/2 ..... N77-32028 #
PB-267207/9 ..... N77-31347 #
PB-267214/5 ..... N77-31595 #
PB-267232/7 ..... N77-31475 #
PB-267280/6 ..... N77-31725 #
PB-267304/4 ..... N77-32052 #
PB-267309/3 ..... N77-32050 #
PB-267314/3 ..... N77-31684 #
PB-267315/0 ..... N77-31683 #
PB-267321/8 ..... N77-32027 #
PB-267332/5 ..... N77-32024 #
PB-267353/1 ..... N77-31346 #
PB-267361/4 ..... N77-31760 #
PB-267369/7 ..... N77-31755 #
PB-267372/1 ..... N77-31756 #
PB-267389/5 ..... N77-31751 #
PB-267401/8 ..... N77-31512 #
PB-267402/6 ..... N77-31513 #
PB-267403/4 ..... N77-31514 #
PB-267404/2 ..... N77-31515 #
PB-267412/5 ..... N77-31754 #
PB-267413/3 ..... N77-31735 #
PB-267419/0 ..... N77-31798 #
PB-267422/4 ..... N77-31817 #
PB-267477/8 ..... N77-32026 #
PB-267525/4 ..... N77-31753 #
PB-267568/4 ..... N77-32047 #
PB-267569/2 ..... N77-32048 #
PB-267570/0 ..... N77-32049 #
PB-267575/9 ..... N77-31823 #
PB-267578/3 ..... N77-31950 #
PB-267580/9 ..... N77-31557 #
PB-267607/0 ..... N77-31825 #
PB-267644/3 ..... N77-31123 #
PB-267645/0 ..... N77-31122 #
PB-267646/8 ..... N77-31121 #
PB-267647/6 ..... N77-31120 #
PB-267648/4 ..... N77-31119 #
PB-267649/2 ..... N77-31118 #
PB-267650/0 ..... N77-31117 #
PB-267651/8 ..... N77-31116 #
PB-267652/6 ..... N77-31115 #
PB-267654/2 ..... N77-31114 #
PB-267661/7 ..... N77-31761 #
PB-267667/4 ..... N77-31331 #
PB-267675/7 ..... N77-32056 #
PB-267683/1 ..... N77-32054 #
PB-267722/7 ..... N77-31664 #
PB-267754/0 ..... N77-31596 #
PB-267772/2 ..... N77-31348 #
PB-267773/0 ..... N77-31857 #
PB-267775/5 ..... N77-31686 #
PB-267777/1 ..... N77-31403 #
PB-267829/0 ..... N77-31665 #
PB-267832/4 ..... N77-31663 #
PB-267865/4 ..... N77-31685 #
PB-267870/4 ..... N77-31435 #
PB-267901/7 ..... N77-31666 #
PB-267912/4 ..... N77-32053 #
PB-267918/1 ..... N77-31286 #
PB-267923/1 ..... N77-31824 #
PB-267926/4 ..... N77-31687 #
PB-267943/9 ..... N77-31688 #
PB-268008/0 ..... N77-31689 #
PB-268043/7 ..... N77-31599 #
PB-268060/1 ..... N77-31113 #
PB-268067/7 ..... N77-31667 #
PB-268232/6 ..... N77-32051 #
PB-268335/7 ..... N77-32055 #
PB-268661/6 ..... N77-32064 #
PB-268674/9 ..... N77-31597 #
PB-268703/6 ..... N77-31600 #
PB-268713/5 ..... N77-31598 #
PB-268736/6 ..... N77-31762 #
PB-268891/9 ..... N77-31763 #

PDO-6989258 ..... N77-31511 #

PERC/RI-77/5 ..... N77-31671 #

PGSTR-AP77-61 ..... N77-31693*#

PGSTR-PH77-62 ..... N77-31963*#

POLY-EE/EP-76-022 ..... N77-31495 #

POLY-EE/EP-77-025 ..... N77-31382 #

PPPL-1324 ..... N77-31973 #

PR-1 ..... N77-31249 #
PR-1 ..... N77-31620 #

PRINT-95-2 ..... N77-31608 #
PRINT-95-3 ..... N77-31609 #

PRS-24 ..... N77-31689 #

PSI-TR-82 ..... N77-31486 #

PT-4964 ..... N77-31613*#

PWA-FR-8496 ..... N77-31160 #

PX-11932-F ..... N77-31828 #

QPR-6 ..... N77-31849 #
QPR-7 ..... N77-31563*#
QPR-8 ..... N77-31564*#
QPR-10 ..... N77-31279 #
QPR-13 ..... N77-31617 #

QR-1 ..... N77-31961 #
QR-2 ..... N77-31479 #

R-752 ..... N77-31429 #
R-753 ..... N77-31910 #
R-754 ..... N77-31802 #
R-756 ..... N77-31998 #
R-763 ..... N77-31937 #
R-764 ..... N77-31424 #
R-765 ..... N77-31846 #
R-1889-AF ..... N77-31334 #
R-2056-ARPA ..... N77-31284 #

RA-163 ..... N77-31351

RADC-TR-77-1 ..... N77-31872 #
RADC-TR-77-12 ..... N77-31521 #
RADC-TR-77-16 ..... N77-31415 #
RADC-TR-77-52 ..... N77-31430 #
RADC-TR-77-68 ..... N77-31716 #
RADC-TR-77-74 ..... N77-31400 #
RADC-TR-77-81 ..... N77-31357 #
RADC-TR-77-85 ..... N77-31382 #
RADC-TR-77-86 ..... N77-31907 #
RADC-TR-77-102 ..... N77-31866 #
RADC-TR-77-105 ..... N77-31990 #
RADC-TR-77-106 ..... N77-31828 #
RADC-TR-77-108 ..... N77-31358 #
RADC-TR-77-109 ..... N77-31416 #
RADC-TR-77-121 ..... N77-31829 #
RADC-TR-77-126-VOL-3 ..... N77-31832 #
RADC-TR-77-144 ..... N77-31243 #
RADC-TR-77-145 ..... N77-31588 #
RADC-TR-77-146 ..... N77-31468 #
RADC-TR-77-148 ..... N77-31819 #
RADC-TR-77-150 ..... N77-31804 #
RADC-TR-77-151 ..... N77-31412 #
RADC-TR-77-156 ..... N77-31376 #
RADC-TR-77-160 ..... N77-31421 #
RADC-TR-77-163 ..... N77-31954 #
RADC-TR-77-169 ..... N77-31395 #
RADC-TR-77-170-VOL-1 ..... N77-31851 #
RADC-TR-77-170-VOL-2 ..... N77-31852 #
RADC-TR-77-180 ..... N77-31232 #
RADC-TR-77-184 ..... N77-31876 #
RADC-TR-77-190 ..... N77-31398 #
RADC-TR-77-192 ..... N77-31844 #
RADC-TR-77-201 ..... N77-31841 #
RADC-TR-77-212 ..... N77-31845 #
RADC-TR-77-217 ..... N77-32025 #

RAE-TR-74008 ..... N77-31143 #
RAE-TR-74131 ..... N77-31460 #
RAE-TR-75041 ..... N77-31103 #
RAE-TR-76006 ..... N77-31303 #
RAE-TR-76027 ..... N77-31105 #
RAE-TR-76030 ..... N77-31106 #
RAE-TR-76053 ..... N77-31104 #
RAE-TR-76082 ..... N77-31302 #
RAE-TR-76085 ..... N77-31301 #
RAE-TR-76090 ..... N77-31551 #
RAE-TR-76094 ..... N77-31304 #

RC-6468 ..... N77-31837 #

RD/B/N-3647 ..... N77-31472 #

RDR-1778-7 ..... N77-31320 #

RE-536 ..... N77-31214*#

REPT-3 ..... N77-31570*#
REPT-3 ..... N77-31571*#
REPT-6 ..... N77-31573*#
REPT-16 ..... N77-31192*#
REPT-53-0200-0001 ..... N77-31586 #
REPT-76-11 ..... N77-31412 #
REPT-77-FM-36 ..... N77-31215*#
REPT-77-FM-37 ..... N77-31234*#
REPT-77-9F5-GATTF-R1 ..... N77-31405*#
REPT-77-9G9-MEMRY-R1 ..... N77-31999 #
REPT-77ISP009 ..... N77-31843 #
REPT-094-007564 ..... N77-31503 #
REPT-257-4 ..... N77-31390 #
REPT-338-7 ..... N77-31110 #
REPT-014534-F ..... N77-31452 #

RG-77-6 ..... N77-31373 #

RI/RD77-195 ..... N77-31500*#

RIA-R-TR-77-010 ..... N77-31327 #

RM-624 ..... N77-31989 #
RM-629 ..... N77-31604 #
RM-640 ..... N77-31952 #
RM-642 ..... N77-31951 #

RR-1 ..... N77-32022 #
RR-76-9D9-CRYMT-R1 ..... N77-31349 #
RR-77-2 ..... N77-31959 #
RR-77-4 ..... N77-31875 #
RR-88 ..... N77-32015 #
RR-193 ..... N77-31552 #

RRA-M7701 ..... N77-31732 #

RRL-478 ..... N77-31476*#

RT-767 ..... N77-31903 #
RT-1814 ..... N77-31593 #

RTR-026-1 ..... N77-31241 #

RUS-PATENT-CLASS-52-518 ..... N77-31601*

R77AEG180 ..... N77-31149*#
R77AEG194 ..... N77-31172 #

S/IS-7701 ..... N77-31865 #

SAM-TR-76-28 ..... N77-31775 #
SAM-TR-76-34 ..... N77-31768 #

SAMSO-TR-77-80 ..... N77-31263 #
SAMSO-TR-77-92 ..... N77-31328 #
SAMSO-TR-77-94 ..... N77-31995 #
SAMSO-TR-77-97 ..... N77-31717 #
SAMSO-TR-77-99 ..... N77-31256 #
SAMSO-TR-77-109 ..... N77-31483 #

SAMTEC/DET1-TR-77-03 ..... N77-31491 #

SAN/1111-76-4 ..... N77-31624 #

SAND-75-0409 ..... N77-31509 #
SAND-76-0425 ..... N77-31619 #
SAND-76-0634 ..... N77-31454 #
SAND-76-0665 ..... N77-31657 #
SAND-76-0723 ..... N77-31630 #
SAND-76-0728 ..... N77-31493 #
SAND-76-5844 ..... N77-31295 #
SAND-76-6005 ..... N77-31298 #
SAND-77-0007 ..... N77-31427 #
SAND-77-6003 ..... N77-32008 #

SAR-2 ..... N77-31763 #

SATR-5 ..... N77-31430 #

SCIENTIFIC-1 ..... N77-31724 #

SCIENTIFIC-2 ..... N77-31746 #
SCIENTIFIC-4 ..... N77-31261 #
SCIENTIFIC-5 ..... N77-31709 #

SC5027.4FR ..... N77-31991 #

SD-76-SA-0093-2-1 ..... N77-31236*#

SDAC-TR-76-13 ..... N77-31701 #

SD77-HSFC-2115 ..... N77-31859*#

SEA GRANT PUB-56 ..... N77-31763 #

SERIAL-T-345 ..... N77-31879 #
SERIAL-T-347 ..... N77-31517 #
SERIAL-T-353 ..... N77-31518 #

SP11 ..... N77-31996 #

SGD-392-PT-2 ..... N77-32064 #

SN-8249-A2 ..... N77-31313*#

SPL-16 ..... N77-31359 #
SPL-17 ..... N77-31833 #
SPL-18 ..... N77-31803 #

SQUID-MICM-17-PU ..... N77-31098 #

SQUID-PU-R1-77 ..... N77-31445 #

SR-4 ..... N77-31415 #
SR-77-1 ..... N77-31976 #

SRD-77-001 ..... N77-31401 #

SRI-MP-77-41 ..... N77-31242 #

SRI-0816-6 ..... N77-31835 #
SRI-4462-SUPPL ..... N77-31126 #

SRIO-77-1-VOL-1 ..... N77-31138 #

SRS-440 ..... N77-31554 #

SS-503 ..... N77-31666 #

SSDC-8 ..... N77-32010 #

SSL-SER-18-ISSUE-44 ..... N77-31569*#
SSL-SER-18-ISSUE-50 ..... N77-31576*#
SSL-SER-18-ISSUE-52 ..... N77-31560*#

STIB-2/76 ..... N77-32017 #

SU-CHR-77-14 ..... N77-31997 #

SU-SEL-77-002 ..... N77-31818 #

SU-STAN-CS-77-598 ..... N77-32020 #
SU-STAN-CS-77-603 ..... N77-31855 #

SWRI-15-3903(3) ..... N77-31522 #

T-38 ..... N77-32014 #
T-644 ..... N77-31862 #

TAEG-44 ..... N77-31231 #
TAEG-47 ..... N77-31780 #

TB-134(1977) ..... N77-31541 #

TCRL-7 ..... N77-31173 #

TECH-MAN-SER-6 ..... N77-31473 #

TEST/80-2-76 ..... N77-31417 #

TI-ALEX(01)-TR-76-08 ..... N77-31703 #

TI-TR-08-77-07 ..... N77-31395 #

TID-26619 ..... N77-31847 #
TID-27148 ..... N77-31470 #
TID-27163-P1 ..... N77-31296 #
TID-27348/2-VOL-2 ..... N77-31639 #
TID-27348/3-VOL-3 ..... N77-31638 #
TID-27375REV-3 ..... N77-31848 #

TID-27424/1-VOL-1 ..... N77-31945 #
TID-27427 ..... N77-31646 #
TID-27428 ..... N77-31645 #
TID-27429 ..... N77-31648 #
TID-27430 ..... N77-31644 #
TID-27431 ..... N77-31642 #
TID-27432 ..... N77-31647 #
TID-27433 ..... N77-31643 #
TID-27435 ..... N77-31655 #

TM-74-16 ..... N77-31159 #
TM-74-78 ..... N77-31504 #
TM-76-258 ..... N77-31464 #

TN-5-77 ..... N77-31911 #
TN-1976-45 ..... N77-31377 #
TN-1977-4 ..... N77-31224 #
TN-1977-14 ..... N77-31419 #
TN-1977-20 ..... N77-31831 #

TOP-2-2-614 ..... N77-31766 #
TOP-7-3-506 ..... N77-31111 #

TR-1 ..... N77-31277 #
TR-1 ..... N77-31781 #
TR-1 ..... N77-31912 #
TR-2 ..... N77-31291 #
TR-4 ..... N77-31357 #
TR-5 ..... N77-31764 #
TR-5 ..... N77-31978 #
TR-6 ..... N77-31306 #
TR-6 ..... N77-31615 #
TR-7 ..... N77-31928 #
TR-10 ..... N77-31254 #
TR-10 ..... N77-31317 #
TR-11 ..... N77-31329 #
TR-12 ..... N77-31264 #
TR-12 ..... N77-31316 #
TR-17 ..... N77-31519 #
TR-21 ..... N77-31988 #
TR-26 ..... N77-32001 #
TR-28 ..... N77-31549 #
TR-28 ..... N77-31906 #
TR-31 ..... N77-31362 #
TR-66 ..... N77-31422 #
TR-67 ..... N77-31520 #
TR-76-2 ..... N77-32054 #
TR-76-10 ..... N77-31804 #
TR-77-2 ..... N77-31915 #
TR-77-4 ..... N77-31914 #
TR-77-388100-1 ..... N77-31843 #
TR-007(2604)-1 ..... N77-31483 #
TR-125 ..... N77-31818 #
TR-0077(2250-10)-2 ..... N77-31995 #
TR-0077(2260-20)-7 ..... N77-31717 #
TR-0077(2270-10)-2 ..... N77-31263 #
TR-0077(2270-30)-4 ..... N77-31328 #
TR-0077(2270-30)-5 ..... N77-31256 #
TR-2140-77-92 ..... N77-31705 #

TRW-26232-6004-TU-01 ..... N77-31575*#
TRW-26904-H019-RO-00-VOL-2B ..... N77-31233*#
TRW-29115-6001-RU00 ..... N77-31829 #

TUM-MITT-142 ..... N77-31219 #

TVA-PRS-24 ..... N77-31689 #

U-6275 ..... N77-31262 #

UAH-RR-198 ..... N77-31489 #
UAH-RR-199 ..... N77-31485 #

UCB/AM-77-1 ..... N77-32004 #
UCB/AM-77-2 ..... N77-32005 #

UCD-472-500 ..... N77-31672 #

UCID-17176 ..... N77-31248 #
UCID-17380 ..... N77-31939 #
UCID-17387 ..... N77-31967 #
UCID-17389 ..... N77-31426 #

UCRL-13711 ..... N77-31626 #
UCRL-52104 ..... N77-31270 #
UCRL-52180 ..... N77-31628 #
UCRL-52203 ..... N77-31968 #
UCRL-52212 ..... N77-31947 #
UCRL-52215 ..... N77-31970 #

UCRL-74024 ..... N77-31492 #
UCRL-78581-REV-2 ..... N77-31494 #

UDRI-TR-76-85 ..... N77-31797 #

UEC-LLL-760920 ..... N77-31626 #

UERL-1 ..... N77-31641 #
UERL-2 ..... N77-31297 #
UERL-3 ..... N77-31640 #

UILU-ENG-76-2241 ..... N77-31910 #
UILU-ENG-77-0512-PT-1 ..... N77-31156*#
UILU-ENG-77-0513-PT-2 ..... N77-31157*#
UILU-ENG-77-0514 ..... N77-31158*#
UILU-ENG-77-2201 ..... N77-31802 #
UILU-ENG-77-2203 ..... N77-31998 #
UILU-ENG-77-2210 ..... N77-31937 #
UILU-ENG-77-2211 ..... N77-31424 #
UILU-ENG-77-2212 ..... N77-31846 #
UILU-ENG-77-2214 ..... N77-31903 #
UILU-ENG-77-2539 ..... N77-31476*#

UIO-SR-77-01 ..... N77-32061 #
UIO-SR-77-02 ..... N77-32062 #

USTA-MA-06-0081-77-1 ..... N77-32055 #

UNC-SG-77-08 ..... N77-31762 #

UR-003-REV-3 ..... N77-31848 #

US-PATENT-APPL-SN-228229 ..... N77-31308*
US-PATENT-APPL-SN-562499 ..... N77-31350*
US-PATENT-APPL-SN-564622 ..... N77-31497*
US-PATENT-APPL-SN-625781 ..... N77-31404*
US-PATENT-APPL-SN-674700 ..... N77-31308*
US-PATENT-APPL-SN-691256 ..... N77-31465*
US-PATENT-APPL-SN-717319 ..... N77-31601*
US-PATENT-APPL-SN-730780 ..... N77-31132*#
US-PATENT-APPL-SN-779429 ..... N77-31176*#
US-PATENT-APPL-SN-785279 ..... N77-31131*#
US-PATENT-APPL-SN-786913 ..... N77-31237*#
US-PATENT-APPL-SN-826203 ..... N77-31668*#
US-PATENT-APPL-SN-826204 ..... N77-31501*#
US-PATENT-APPL-SN-829314 ..... N77-31787*#
US-PATENT-APPL-SN-829316 ..... N77-31213*#
US-PATENT-APPL-SN-829321 ..... N77-31407*#
US-PATENT-APPL-SN-829390 ..... N77-31610*#
US-PATENT-APPL-SN-830272 ..... N77-31800*#
US-PATENT-APPL-SN-830382 ..... N77-31611*#
US-PATENT-APPL-SN-831631 ..... N77-31583*#
US-PATENT-APPL-SN-831632 ..... N77-31260*#
US-PATENT-APPL-SN-831633 ..... N77-31130*#
US-PATENT-APPL-SN-831634 ..... N77-31135*#

US-PATENT-CLASS-52-173 ..... N77-31601*
US-PATENT-CLASS-123-DIG.8 ..... N77-31497*
US-PATENT-CLASS-123-3 ..... N77-31497*
US-PATENT-CLASS-123-37 ..... N77-31497*
US-PATENT-CLASS-123-59E N77-31497*
US-PATENT-CLASS-123-119A N77-31497*
US-PATENT-CLASS-123-122AB N77-31497*
US-PATENT-CLASS-136-89-AC N77-31601*
US-PATENT-CLASS-136-89P N77-31601*
US-PATENT-CLASS-210-DIG.27 ..... N77-31308*
US-PATENT-CLASS-210-40 ..... N77-31308*
US-PATENT-CLASS-260-2.5A N77-31308*
US-PATENT-CLASS-260-2.5AM N77-31308*
US-PATENT-CLASS-260-2.5AY N77-31308*
US-PATENT-CLASS-260-77.5AP N77-31308*
US-PATENT-CLASS-323-93 ..... N77-31404*
US-PATENT-CLASS-324-60 ..... N77-31404*
US-PATENT-CLASS-340-200 ..... N77-31404*
US-PATENT-CLASS-340-347SH N77-31404*
US-PATENT-CLASS-343-17.7 ..... N77-31350*
US-PATENT-CLASS-356-212 ..... N77-31465*

US-PATENT-4,039-489 ..... N77-31308*
US-PATENT-4,040,041 ..... N77-31404*
US-PATENT-4,040,750 ..... N77-31465*
US-PATENT-4,040,867 ..... N77-31601*
US-PATENT-4,041,910 ..... N77-31497*
US-PATENT-4,042,926 ..... N77-31350*

USAAEPA-75-08 ..... N77-31136 #

USAARL-77-4 ..... N77-31790 #

USAAVSCOM-TR-77-31 ..... N77-31142 #
USAAVSCOM-TR-77-34 ..... N77-31882 #

USAFA-TR-76-20 ..... N77-31223 #

USAFIFC ..... N77-31147 #

USAMIIA-K-7088 ..... N77-32038 #

USCG-D-19-77 ..... N77-31587 #

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